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The Royal Society of London

PHILOSOPHICAL TRANSACTIONS

Volume 15
1685

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PHILOSOPHICAL
Transactions,
GIVING SOME
ACCOMPT
OR THE
Present Undertakings, Studies, and Labours,
OF THE
INGENIOUS,
IN MANY
Considerable Parts
OF THE
VVORLD.

VOL. XV.

For the Year of our Lord, M.DC.LXXXV.

OXFORD,

Printed at the *THEATER*, and are to be sold by *Samuel Smith*, at the *Prince's Arms* in *S^t Paul's Church-yard*, *London*; and *Henry Clements*, Bookseller in *Oxford*. 1686.

To The
RIGHT HONORABLE
FULKE LORD BROOKE
Of
Beauchamp's Court.

MY LORD;

HAVING Completed the *fifteenth Volume of the Philosophical Transactions*, (which contains part of the great Stock of *Experimental Learning*, communicated to the Royal Society the last year,) I now Humbly Dedicate it to Your Lordship; a Person of Honor, always ready to Favor, whatever makes for the Improvement of Knowledge, and the Public Good.

But this imperfect Character of Your Lordship, tho' of it self sufficient to Justify the present Address, is not the only Inducement to it: I could mention, how much We are all indebted to Your Lordship, for a Uniform and Steddy Loyalty to the King, and a Pious Love for Your Country:
I

I might add, That Your Lordship's Kindness has reacht the Publisher of these Tracts, and made Him wholly Your Own: But I must take care, not to be Uneasy to Your Lordship; who is more inclined to Do great things, then to Hear of them after they are done.

Wherefore, I shall only recommend to Your Lordship's Patronage and Protection, the following Discourses: Some of which retrieve lost Peices of Antiquity, (as the Incombustible Cloth, &c.) and by these means add to the Authority of the Antients, who have suffered in their Reputation by Our Ignorance: Others extend the bounds of Learning, and inform Mankind by New Discoveryes: These are all presented to Your Lordship, in token of a much greater Debt, from,

MY LORD,

Your Lordship's most Obedient Humble Servant,
WILLIAM MUSGRAVE,
Reg. Soc. Sec.

Beginning the fiveteenth Volume.

PHILOSOPHICAL

TRANSACTIONS.

Jan. 28th. 1684.

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A

Some Ex-

Some *Experiments* about *Freezing*, and the difference betwixt common *fresh Water* Ice, and that of *Sea Water* : also a probable Conjecture about the Original of the *Nitre* of *Ægypt* : by Dr. *Lister*, *Fellow of the Royal Society*.

D Ecember 3d 1684 at Night I exposed 4 Glasse bottles in the open aire upon the ground to *freeze*; viz, of the *Red-Natron* Water from *Ægypt*; of a strong Solution of *Nitrum Murarium* in fair Water, of *Sea Water* taken up at *Scarborough* and more then halfe Evaporated; of the *Sulphur* well at *Knasborough*, that is, of natural brine evaporated to the same height with the *Sea Water*.

Note, that the 4th in the morning, the Solution of *Nitrum Murarium* was halfe of it Ice, but not any of the rest.

The 6th in the morning, the bottle of *Nitrum Murarium* was most Ice; the *Sulphur* Water had no Ice that I could perceive at all in it: the *Natron* had much Ice at the bottom of the bottle; and the *Scarborough* sea Water was not without flakes of Ice.

The Icicles of the *Natron* were prettily figured, as is represented in Fig. 1. the Icicles of the *Sea Water* were also figured in oblong squares, as in Fig: 2. and were brittle and transparent. I set the drained Icicles of *Natron* before the fire, which did readily enough melt & dissolve into water again; this Ice was both alike salt in Ice and in Water, much like its Water to the tast, out of which it was frozen.

In like manner having drained the *Sea Water* Ice, and exposed it before the fire; these Icicles became soft and moist by degrees, but at length rather Evaporated, than quite melted away; and having taken up a good thick lump

lump of *common Ice*, at leaſt a 100 times their thickneſſe & bulk, this in a few moments at the ſame diſtance before the fire, grew wetter and wetter and diſſolved into water, whereas the *Salt Icicles* after 3 quarters of an hour, lying before the fire did at length dry into a white powder perfect Salt, the moiſture totally Evaporating.

Alſo the *Sea Water Icicles* taſted very Salt, when firſt taken out of the Water.

I repeated the ſame experiment of expoſing to freeze the bottles of *Natural Brine* of *Knaſborough Sulphur* well halfe Evaporated, and *Scarborough Sea Water*, the ſame as formerly, the 7 and 8 th inſtant at Night, & with the like ſucceſſe; viz, no Icicles in the natural brine, but the ſame large ones as above deſcribed I had in the Sea Water, but not till after the 2d Nights keen freezing.

Theſe *Salt Icicles* continued unthawed in the bottles, though they were brought into the Houſe and kept in a warm room long after all other Ice within doors was gone, viz, till the 12th inſtant at Night, when the Icicles alſo were diſſolved and vaniſht.

From which Experiments we note, 1. that there may be *Salt Ice* from *Sea Water* frozen, which the Experiments of this S. of the laſt year did not ſeem to favour.

2. that there is a real difference betwixt *natural Brine*, and *Sea Water*; as there is betwixt the Salts themſelves, which they yield.

3. That the great floating Mountains of Ice in the Northern Seas (if upon ſtrict Tryal they ſhall be found to be ſalt, which ſhould be further enquired into,) are not only the effects of many yeares freezing, but alſo much of their magnitude may be owing to the natural duration of that ſort of Ice.

Before I end, give me leave to gueſſe at the original of the *Nitre* of *Ægypt*, which the Experiments made about it at *Oxford* plainly ſhew to be little different from *Salt Armoniac*.

That considering that it raines little or nothing comparatively to the great heats, in *Ægypt*; and that the Lakes there are only once a year furnisht with fresh Water from the overflowings of *Nile*; also that vast tracts of Land there and all over *Asia* are naturally covered with fossil Salt; again those Lakes are furnisht with vast Animals as *Crocodiles*, *Hippopotami*, and without doubt great variety of other lesser Vermine; these things I say, well considered, it is easy to think, that in a years time, most the Salt Water of those Lakes has past through the Bodies of those Animals, and consequently is become Urinous or Salin-Urinous, as is the nature and composition of factitious *Sal Armoniac*.

Letter from Dr. Turberville of Salisbury containing some considerable Observations in the Practice of Physic.

Sir!

I will now proceed in communicating more of my Observations to you; at present be pleas'd to accept these which follow.

I had a Gentlewoman my Patient, who was much troubled with the falling Sickneſs; in her Water I ſaw a great number of ſhort Worms, full of legs, and like *Millepedes*: I gave her two or three purges, firſt with *Pil: Agaric: & Rhubarb*; but I ſtill perceiv'd, in every Water was brought me, eight, or ten, or more, of the Worms; they appear'd lively, and full of Motion; and the fits continued daily: at laſt I gave Her half an ounce of *Oxymel Helleboratum* in Tanſy Water; which wrought well and was ſucceſſfull; ſo that ſhe had a compleat cure. I ſhall leave you to judge of the cauſe of the Malady.

About ſix or ſeven years ſince, I had a Gentleman (Mr. Oyliff by name,) in cure of his Eye; which was as big as my fiſt, black, fleſhy, and full of blewish bladders; this I judgd to be a *Cancer*: after purging, and bleeding, I cut out the ball, and ulcerd fleſh, by many Cuts, which were all inſenſible to Him, till I came to the Optic Nerve: at the laſt Cutt He complain'd, and bled a little; the Wound was heal'd in about a fortnight; He now wears a black patch over the place.

Not long after this, a young man (my Patient,) had an Eye as big as a Hen's Egg, very fair, without ble-miſh, Rheum, or redneſs; and his ſight was pretty tolerable; I judgd theſe Symptomes to proceed from thin humors fallen on the Eye, and Extending its Coats:

I cured this distemper by applying drying Medicines to the head, and Eyes, and making an Issue in Nucha, appello Morbum *Oculum Bovinum*, five *Oculi Hydropem*: If these Observations are acceptable to you, you may command more of a like nature from.

Sarum

Your very humble

Dec. 10th

Servant

1684.

Dawbeney Turberville.

Obfer-

Observations on the Cicindela Volans, or Flying Glow-worm, with the figure thereof made, and Designed by Richard Waller Esq. F. of the R. S.

THE *Cicindela volans*, tho' it hath bin pretty well described by several writers that treat of Insects, yet I think has bin by none mentioned to be found in England, and indeed it is very rare, but I have happened to catch twice of them at Northaw in Hertfordshire; first about Midsummer 1680, and for a fortnight in June the last year 1684. they flew about the candle as soon as it grew dark; at both which times the weather was very hot, and it may be it shines only at such seasons, tho' the Animal be easy enough to be met withall winged when it shines not, and without wings shin'ing which is the common Glow-worm.

By *Ulysses Aldrovandus* Lib: 4. cap. 8. it is thus described. *Cicindela pennata* pennas habet in vaginis fuscis inclusas, Caput à superna parte ceu Cucullo quodam clypei inversi, & incumbentis formam habente totum contegitur, fusci ut vaginæ coloris. Caputulum ei parvum nigerrimum, in duo tubercula dispartitum, ceu gagatis splendore ocellos. Alvim habet annulosam multis segmentis divisam in cuius extremo guttulæ duæ ignis instar pellucidæ, sed è lucido igneo ad viride seu subcæruleum tendentes, qualis nonnunquam flammæ est ex sulphure incenso color. Conspectiuntur tunc maxime cum albo compressa humor ille Diaphanus ad extremum alvi vergit, &c:

I have been the larger in transcribing this Description, because it agrees very well with the Animal whose figure I here present to the Society; as touching its Generation, *Aldrovandus* ib. affirms ovis quæ

parit *Cicindela*, Erucam quandam fieri, & ex hac tandem alatam gigni, &c. It is much to the same purpose described by ^a *Moufet*, and ^b *Thomas Bartholin* in his *Treatise De luce Animalium*. Save that they both I think mistake in allowing the Male only to have wings, whereas they both fly alike, as we may conclude was known to *Julius Scaliger* Exer. 191. from a place it seemes not regarded tho' cited by *Moufet*, where he says *Cicindelam Volantem cum suo Mari in coitu deprehendi*, &c. The same which happened to me, for I once caught the Male, and Female coupled, and could observe no Difference between them, except in Size, the Female being a little the larger, for they both shined alike. Its Light was very vivid so as to be seen plainly when a Candle was in the Room, but the vibrations thereof were unequal, and the Colour greenish like that of the creeping Glow-worm. The luminous part was two small specks on the under side of the Tail at its End. The shineing continued for a little while after the Tail was cut off, tho' it sensibly decayed, till at last it went quite out. Whether it shined longer then the Life remained in that part (which will live for a considerable time in all Insects after it has been severed from the body,) I much doubt; and *Moufet* says *Clarissimum istum splendorem una cum spiritu vitali prorsus evanescere*. Possibly the use of this light is to be a Lantern to the Insect in catching its prey, and to direct its course by in the Night, which is made probable by the Position of it on the under part of the Tail, so that by bending the same downward (as I always observed it to do,) it gives a light forward upon the Prey, or object: the Luminous Rayes in the mean time not being at all incommodious to its sight, as they would have bin, if this Torch had been carryed before it. This conjecture is also favoured by the placing of the Eyes, which are on the under Part of the head, not on the Top. I obser-

^a Cap. 15, p. 108. ^b Lib. 2, c. 12.

ved also that it could and did by some contrivance cover its Light, and make a kind of dark Lantern. I should have been very glad to have given some account of this Light from Experiments that might have bin made thereon but not having the opportunity of doing it whilst the Flyes lived which was not above a day after they were taken, and wanting my Microscope in the Country to examin it more nicely while shining, I must be contented with offering a Draught of the Insect such as I could then make, and a larger representation of it as the Microscope shewed it being laid on its back, when it had been some time dead.

The 3d. Figure shews the Insect upon its feet, with the back upwards, where it appears to be of the *Beetle* kind; it is of a dark Brown colour unpolisht, when the case wings are opened, it extends two very large membranous wings, fastened to the upper part of the Thorax; Its head is covered as it were with a shield or broad-brim'd Hat.

The 4th Figure represents it laid on the Back, to shew the two Eyes under the broad covering, they are black, and very large, making almost the whole head; there being little else to be seen: these are movable, so that the Animal can thrust them forward to the Edge of its hat. From between these are discovered the two hairy feelers, or perhaps Brushes to cleanse the Eyes. Between these Eyes and the Thorax lyes the Mouth: on the Thorax are 6 Legs almost all of a length. The Tail is made of 7 shelly Rings, at the last of which are visible the two shining points.

The 5th Figure shews the Insect on its back as it was seen through a Microscope when dead; where

AA. Represents the two Horns, feelers, or Brushes consisting of 10 roundish joynts, besides the first, which is as long as two of the Rest, they are all hairy, and like those of some Butterflays, for all have them not.

BB. The broad covering, or Hat over the head which shewed of a speckled brown and yellowish colour, like Tortois shell.

CC. The two Eyes composed of innumerable small glassy Hemispheres in rows as hath been observed by the Ingenious Mr. *Hook* in his *Micrography* to be the make of insects Eyes, so to supply the defect of motion in their Eyes, by the number of Pupilla's. I have seen these spherical bodys in the Eyes of some Butterflies set in circles not Rows; with long hairs growing out of each space left by the connexion of three Hemispheres.

D. D. D. D. D. D. The Legs of a shelly-make like Lobsters, and so joynted. As well in this as other Flys they are covered with many stiff hairs, tho' not so full as those of the Blew fly, as may be seen by comparing Mr. *Hook's* (*Microgr. Schem. 26.*) curious Figure of that Insect with this here. The Mechanisms of the feet, as I take it, are much the same, only what is there called the Pattens, were here wanting (if not broken off as I believe they were not,) and their use supplied by the Gibbous part represented by d. d. d. The Talons e. e. e. e. e. e. of the feet were shining, and very sharp pointed. The Legs were of two long joynts, and the feet of four more, beside that which was armed with the Talons. These seemed to be joynted one into another, and were all thick beset with haire, or Bristles.

E. The Thorax of but one shell, of a Polisht copper colour, stuck full of tapering Bristles, a small dent being discernable in the shell wherein each grew.

F. The Taile consisting of 7 Rings, of the same brownish colour, without hairs except on their Edges, which were set with them like a thin fringe, as the Tails of Lobsters, &c. are. These Rings were of an unequal shining shel-cover.

f. f. The back, or upper part of two or three Rings of
the

the Taile, turned up to shew the work of the shell on that side. On the Inside of the last of these was the light placed, tho' there was now nothing to be seen except that part being a little lighter coloured then the rest of the Taile.

g. g. g. g. The Membranous Wings in every particular like those of the Blew Fly, with hairs upon the veins, or quilly Parts.

h. h. h. h. The insides of the Case wings, which were hairy, pointing all downwards. The outside of these Cases is also very Bristly,

*A Letter of Mr. John Davis Minister of little Leak
in Nottinghamshire to one of the F. of the R. S.
concerning the Wurtemberg Engine Dated 26th.
November. 1684.*

QUUM elapsa nuper æstate essem Londini, in manus incidit Tractatus quidam inscriptus *Sipho Wurtembergicus*, sive Sipho inversus Cruribus æquealtis fluens & refluens hactenus inauditus, De hac Machina magnifica prædicat Author prædicti libelli, asserens esse unam e duabus Machinis Aquariis, cui mundus parem non habet, si & utilitatem, & raritatem, & artificium spectes, sed Lectorem orat, ut ignoscat Patrono ejus Serenissimo quod mysterium structuræ ejus sibi servet. Dum itaque encomium hoc tam caræ, utilis, & artificiosæ Machinæ legerem, & de Fabricatione ejus serio cogitarem, in mentem venit, quomodo instrui possit Sipho, ut quæ de Wurtembergico illo narrantur, præstaret. Habens ergo in manibus, dum Tractatum illum evolverem, Syphonem quendam Vitreum, me ad inventionem cœlati prædicti Siphonis artificii applicui, & postquam Syphonem meum artificio eo, quod tunc mihi occurrebat, disposueram; erexieum supra duo Vascula quantum potui perpendiculariter; dumque in eo situ sisteretur, affudi in unum ex Vasculis aquam, donec orificium Siphonis paululum superaret, & statim in alterum Vas ut expectabam effluebat aqua: tunc evacuato illo Vase in quod primo aquam infuderam in alterum effudi, & immediate aqua ista refluebat in prius Vas. Hoc dum in prima lectione prædicti libelli occupatus eram, expertus sum, & licet non ausim de Invento hoc gloriari, aut Artificium hujus Syphonis mei cum illo Wurtembergico, quod mihi adhuc (in quantum scio,) ignotum est, comparare: tamen si utilitatem spectemus, cum eo certare posse (præsertim si addatur ei Instrumentum quoddam, modo quodam peculiari à me excogitato,) non multum dubito, &c.

The De-

The Description of a Siphon, performing the same things with the Siphon Wurtembergicus; invented by Dr. Papin Fellow of the Royal Society.

IN tractatu de *Siphone Wurtembergico* qui *Stutgardiae* authore Do. Salomone Reifelio nuper editus est magna quædam atque inaudita, si & utilitatem & raritatem & artificium spectes, de novo illo siphone prædicantur; ipsius autem proprietates characteristicae proponuntur his verbis: 1^o. *Ut orificia crurum duorum Siphonis sui horizontaliter sita labris inserantur; cum in veterum inventis crus longius infra labrum seu æquilibrium descendat semper.* 2. *Ut orificiis vel partim vel ad dimidium aqua repletis, effluat tamen aqua super montem ducta; cum in reliquis Siphonibus totum orificium aqua adimpleri seu immergi aquæ debeat.* 3. *Ut in siccitate diuturna quiescens machina tamen effectum producat affluente iterum aqua.* 4. *Ut lumine seu orificio alterutro aperto, altero vero post horas demum aut diem seu per epistomium seu conum recluso, effluat tamen aqua; cum in aliis utraque simul lumina aperiri debeant.* 5. *Ut in horizontali linea positis orificiis, & æqualibus quoad altitudinem cruribus exundet liquor; cum in Portæ aliorumque Machinis inæqualia debeant crura esse, & perpendiculum majus.* 6. *Ut ab utroque labro in utrumque labrum infusa ascendat & effluat aqua; cum in veteribus nonnisi per unicum nempe longius, crus effluat, nunquam resluat.* Hæc sunt ipsius verba Authoris, qua vero ratione, quibusve auxiliis tanti effectus produci possint, ne verbum quidem: Me, itaque, Jussit Regia Societas Machinam construere, quæ eadem illa in libro descripta Phænomena exhiberet, ut clarissimus author de orbe litterato multoties tam bene meritis, ad ultiores Siphonis sui proprietates & usus detegendos provocetur: quum quæ de eo hætenus edita sunt cuncta, tam facili negotio ab aliis effecta viderit. Rem igitur tribus variis modis exequutus sum; ne vero

tædiosus nimium videar, sequentem methodum utpot facillimam instar omnium fore arbitror.

AA. sunt duo vasa metallica quibus duæ Siphonis extremitates inferuntur.

BCDEDCB. est Siphon cujus lumina. BB. in eadem Horizontali linea disponenda sunt.

F. Est tubulus foramini in superiori Siphonis parte adferruminatus, diligenterque obturandus, postquam Siphon aqua exacte repletus fuerit. Jam manifestum est aquam in partibus CD. contentam, aeri externo ingressum prohibere ne ad superiorem Siphonis partem E. penetret: Siphon igitur aqua semper plenus (modo debitam altitudinem non excedat,) effectum suum certissime producet, statim atque aqua in vasibus A contenta alterutrius orificii B partem aliquam replebit: quumque ambobus orificiis aqua partim repletis, in utroque vase A ad eandem horizontalem lineam superficies aquæ pervenerit, si alterutri Vasi vel tantillum aquæ infuderis, pars ejus per siphonem statim in alterum Vas deferetur, eademque ratione cætera in libro descripta phænomena exhiberi poterunt: maximus enim ejusmodi siphon hactenus constructus viginti pedum altitudinem non superat.

A Miscellaneous Catalogue of Mean, vulgar, cheap and simple Experiments. Drawn up by Sr. William Petty, President of the Dublin Society, and by Him presented to that Society

1. **T**HE Weight of a Cubical foot of Sea-Water, fresh River-Water, Spring-Water and Rain-Water; as also of Ale, French Wine, Brandy, Metheglin and Spanish Wine, Oil-Olive, Rape-Oil and Train-Oil?
2. The Weight of a Cubical foot of Wheat, Barly, Peas, Oats? &c.
3. The Quantity and Weight of Juice that ten pound of Apples, Pears, Goosberries, Mulberries, Peaches, and Grapes will yield in order to make Drink?
4. The Weight of a Cubical foot of Oak, Ash, Elm, Fir, Willow, Alder, Birch, Yew, Pear-tree and Box-timber, and the difference between the weight of the said timbers, extreemly green and extreemly dry?
5. The Weight of the Shell, White and Yelk of an Egg, viz. of Pidgeons, Hens, Ducks, Geese and Turkies, and the proportion between the weight of the Egg and the Hen? &c.
6. The Weight of a Cubical foot of Wool, Tow, Feathers, Hey, &c. pres'd down with several weights?
7. The Weight of several Bottles and Cask which are in common use?
8. The Weight of a Cubical foot of Lime, Sand and Mold?
9. The Weight of Apples, Pears, Nuts and other fruits; as also their correspondent Numbers and Magnitudes?
10. Comparative Weight of a hundred Apples born upon the same Tree in several years?
11. Let there be a Bag of Wool, and Shot made thereinto

thereinto by a Musquet, Carbine and Pistol, and let it be observed how far each Bullet pierceth the same ?

12. What space severall sorts of Animals will run in a minute *viz.* a Horse, Greyhound, Hare, Fox, Rabbit, even to a Louse, and other creeping Animals ?

13. The difference of Flight of severall sorts of Birds within the same time ?

14. What Proportion of each sort of Letters are in the English, Latin and French Tongues, &c.

15. Forasmuch as all Printers Letters are of the same height, *quære* the Weight of an Alphabet of the severall usual sizes ?

16. *Quære* how many of each sort of Letters will stand in ten inches square ?

17. *Quære* how many Letters may be composed and distributed in an hour ?

18. What difference in the Duration of a Light made with Tallow, Bees-wax and Oil, and in Tallow of severall ages and sorts ?

19. The Duration of Candles of the same Weight, and Weik of severall bignesses.

20. The difference of Duration of the same Weight of severall sorts of Pit-Coles, and the severall weight of their Ashes, and of the severall quantities of Water that the same will make to boil in the same sort of Furnace and Vessels ?

21. Of the Duration of severall Matches and Coles, and of the time that severall Woods will keep fire raked up in Ashes ?

22. Of the Strength of the same Fires on the severall Blasts, and their different duration ?

23. The proportions of Nitre, Brimstone, and Cole, in the severall sorts of Gunpowder ?

24. The proportions of Oil, Tallow, Salt and Lie in the severall sorts of Soape ?

25. What proportion of Pitch and Tallow for the use of a Ship ?

What

26. What quantity of Tar goes for paying a yard square upon a Ship?
27. What are the proportions of Brimstone and Rosin for graving a Ship?
28. What the proportion of Lime and Sand for Brick mortar.
29. What the proportion of Lime and Hair for Plastering?
30. What the proportion of Linseed-Oil and Oker for Colouring and Priming?
31. What the proportion of Lead and Pewter for Solder?
32. What the weight of Wool and length of Thred in a yard square of the several sorts of Woollen Manufactures?
33. The same for the Manufacture of Hemp, Flax, Cotton, Hair and Silk?
34. The proportion of Meal, Water and Yeast in Bread, in Dow new baked and stale?
35. The proportion of Increase between Dow and the same fermented; between Barly and the same malted?
36. The Proportion of Hemp and Tar in a well-made Rope?
37. The quantity of Stuff in any Garment propounded, and the length of the several Seams and the Sewing Thread, and number of Stitches in the same?
38. The proportion between the Weight, and the Extent of the several Leathers in a shooe?
39. How many Shooes of a certain size, a Shooemaker can make up in a time given?
40. What length of Thred can be spun in ten hours, from Cable-yarn to Taylors brown Thred?
41. What is the length of an Ounce of all fine Thred?
42. To what extent may an Ounce of fine-Gold, Silver,

ver, Tin and Copper be beaten, and to what lengths the same may be drawn into Wire?

43. What is the Weight of an Ox of 1, 2, 3, 4, 5 and 6 years old, in ten several degrees of Pasture in *Ireland*?

44. How do several sorts of Trees increase in weight and height *per annum*?

45. To how many does each sort of Seed multiply?

46. What proportion doth the Kernel of an Apple bear to the Apple it self; with the same for other Fruits and Plants?

47. What is the difference between the Weight of Hyssop and Wormwood, or of any other Herbs, upon the same square of Ground for one years Growth?

48. What is the difference of the Worth of plowing the same quantity of Ground in ten several sorts of Land in *Ireland*?

49. The quantities of Rain that fall in an hour upon the same scope of Land?

50. The several weights of a Fleece of Wool at sheering, kept dry, and in a moist place?

51. What difference in the weight of Hides of Cattel of the same weight?

52. What difference in the way of Ships *per* hour in all varieties of cases?

53. At a certain Point in the Sea, to observe the depth of the Water every hour of the year, with the swiftness and slowness of ebbing and flowing water between any two Points assigned?

54. What are the differences of Illuminations from one to a hundred equal Candles in a parallel-sided Room?

55. The different effects of the Wind, upon the Sound of a Bell?

56. The different distances of time between the
Sound

Sound and Fire of a Gun, and the measuring of the distance of Thunder thereby ?

57. The difference of the weight of Animals by Transpiration, ordinary and extraordinary ?

58. The different proportions of the times of sleeping and waking in several Animals, particularly in Fishes ?

59. The proportion between the length, weight and thicknels of the best Bows and Arrows ?

60. The different effects of Bows at several bents upon the same Arrow ?

61. The different weights of Indico, Madder, Cocheoneel, Weld, Fustick and Logwood, that will dy the same quantity of the same Stuff to a degree assigned ?

62. How much of each of the said dying stuff will produce black ?

63. What is the proportion of Copperas and Gauls for the dying of wool into a black colour ?

With infinite more Experiments of this kind.

A Let-

*A Letter from Mr. J : Beaumont of Stony-Easton in
Sommerfetshire to one of the S. of the R. S. con-
cerning a New way of Cleaving Rocks.*

A worthy Gentleman, who for many years has been a Considerable adventurer in the Lead Mines on *Mendip* hills, being in London a while since, was pleas'd to acquaint me that the Miners there, within these twelve months, had gotten a new way of *Cleaving* Rocks with Gunpowder, whereupon I desir'd he would please to favour me with a Present of the Instruments us'd in it, which I conceiv'd would not be unacceptable in the Repository at Gresham Colledge, where I have now caus'd them to be deliuered.

The first Instrument, which by the miners is call'd the *Borier* describd *Fig. 7* is made of Iron, and is 2 foot 2 Inches in length, it is an Inch square at the steeled end from *a* to *b*, and somewhat lesse in the other part: the use of this Instrument is to make a hole in the Rock deep enough to receive the Powder: the second Instrument, call'd the *Gun* represented *Fig. 8.* is 6. Inches in length, $1\frac{1}{4}$ diameter, and has a hole drill'd through it to receive the priming Powder. The first Instrument is manag'd thus, one man holds it on the Rock and turns it round, while another beats it down with a hammer of five or six pounds weight; when the hole is made somewhat deeper then the length of the *Gun*, they dry it with a rag, and put into it about 2 or 3 Ounces of Powder, over which they put a thin paper, and on it place the *Gun*, which they bind firmly into the hole, by driving in against the flat side of the upper part of it, the third Instrument, which is a little Iron wedge 4 inches in length, by the Miners call'd a *Quinnet* describd *Fig. 9.* when this is done, they pass down a wire through the hole drill'd in the *Gun*, and pierce the
Paper

Paper which covers the Powder and then they prime the *Gun* and lay a traine and goe up out of the work before the Powder comes to take fire; the Paper is put at first over the Powder, lest when the *Gun* and *Quinet* are drive-down, the tooles may strike fire and kindle the Powder.

In number: 5. of the Philosoph. Transact. set forth by Mr. *Oldenburg* there is a way of breaking Rocks with Gunpowder Communicated by Sr. *Robert Moray*, as he received it from Monfr. du *Son* the Inventor, and there is a draught of the Instruments for that purpose, but in regard those Instruments differ in severall things from these, I thought it might not be amiss if these were likewise Inserted,

I know the use of these Instruments will be of great advantage to Miners, and if there are any Minerall works where they are not yet receiv'd, the Miners may doe well to try them; for (beside what will be sav'd in timber in a year that is usd in burning Rocks, which is very considerable,) we know that as soon as a man has fired his Powder and broken the Rock, he may presently go to work again, whereas after a fire is laid in a *Shaft*, a man can scarce go to work in 24 hours after, the Rocks being too hot to suffer him.

A Discourse proving from Experiments, That the larger the Wheels of a Coach, &c. are (cæteris paribus,) the more easily they may be drawn over a Stone or such like obstacle that lies in the way: by a Member of the Philosophical Society of Oxford.

HAVING read in the *Mechanicks* of Merſennus^a, Herigon^b, and Dr. Wallis^c, *That the larger the Wheels of a Coach, &c. are, (cæteris paribus,) the more easily they may be drawn over a Stone or such like obstacle that lies in their way*; I was willing to try some Experiments which I thought might convince some men better of the truth of it, than a Mathematicall demonstration.

I therefore ordered a Modell of a part of a *Wagon* to be made, consisting of 4 wheels, 2 axes and a board nailed upon the axes. The lesser wheels were $4\frac{1}{3}$ inches high, and the bigger wheels $5\frac{2}{3}$ inches high, viz: $\frac{1}{2}$ of the ordinary height of the wheels of a *Wagon*: The weight of the Modell was almost a pound and half. I had also 2 other wheels made $5\frac{2}{3}$ inches high to be put on instead of the lesser. The middle of the 2 axes were $6\frac{1}{4}$ inches asunder. All the wheels turned very easily upon the axes.

A piece of Lead $56\frac{1}{4}$ avoirdupois was laid upon the modell, so forward that the lesser wheels seemed to bear above parts of the weight. Then the modell was drawn with a string laid over a Pulley, the top whereof was $\frac{1}{4}$ of an inch higher then the top of the hinder axis;

^a Geom. pa. 459 ^b Mec. pr. 16. Schol. ^c Mec. c 7. pr. 3 Schol. § 15.
and

and the middle of this Pulley was $7\frac{1}{2}$ inches from the middle of the fore-axis.

The lesser wheels being put on, and the string being tied to the top of their axis,

1. Three pound drew the modell on the smooth levell Table.

2. Twenty pound drew the lesser wheels over a squared rod $\frac{1}{4}$ of an inch thick.

3. Thirty pound drew them over a round rod a little more then half an inch thick.

4. Thirty one pound drew them over a square rod half an inch thick.

5. Twelve pound drew the hinder wheels over the bigger square rod.

The string being laid under the axis, *viz*: $\frac{1}{8}$ of an inch lower then before.

6. Twenty nine pound drew the lesser wheels over the bigger square rod.

Then the 2 bigger wheels being put on instead of the lesser, and the string lying over the axis.

7. Three pound drew the modell on the Table.

8. Twenty five pound drew the Fore-wheels over the round rod.

9. Twenty five pound drew them over the bigger square rod.

10. The string lying under the axis, sixteen pound drew them over the least rod.

11. Twenty three pound drew them over the round rod.

12. Twenty three pound drew them over the bigger square rod.

13. Thirteen pound drew the hinder wheels over the bigger square rod.

All these Experiments were tried twice at least, and most of them 3 or 4 times over

In all of them the Lead was laid exactly upon the

same part of the board, but yet when the lesser wheels were taken off, the Lead did not lean so much forward, so that the hinder wheels were somewhat more pressed than they were before.

By comparing the 2d, 3d and 4th Experiments with the 10th, 11th, and 12th, it appears how much more easily a *Wagon*, &c. might be drawn in rough wayes, if the fore-wheels were as high as the hinder wheels, and if the thills were fixt under the axis. Such a *Wagon* as this would likewise be drawn more easily where the wheels cut in Clay, or Sand, or any soft Ground. And moreover high wheels would not cut so deep as low wheels, as *Dr. Wallis* does plainly demonstrate^d; besides some other advantages which he mentions.

Low wheels are better for turning in a narrow Compass than high ones: But it seems probable that *Wagons* with 4 high wheels might be so contrived that there should be no great inconvenience in that respect; at least such *Wagons* as seldome have occasion to turn short, as *Carriers Wagons* and such like.

The difference which you may observe in the 8th and 11th Experiments, is agreeable to what is said by *S. Stevinus*^e, and *Dr. Wallis*^f; viz. that if a *Coach*, &c. must be drawn over rough, uneven places, it is best to fix the Traces to the *Coach* lower then the height of the *Horses* shoulders. And therefore that is not the best way which some *Wagoners* use, who sometimes putting their horses in pairs, hook the chains of some of the *Horses* to the chest of the *Wagon* higher then they need to do.

14. A Table $2\frac{1}{2}$ foot long was set with one end $8\frac{1}{2}$ inches higher then the other end, and the Modell being loaded as before, less weight by 6 ounces drew it up the Table when the 4 bigger wheels were on, then when 2 bigger and 2 less were on.

^d *Mec.* c. 7. pr. 3. *Schol.* §. 21. ^e *Stat.* l. 3. pr. 2. ^f *Mec.* c. 7. pr. 3. §. 36.

The reason of this is given by Dr. *Wallis* and other Writers of Mechanicks: *viz.* because in the first case there was almost the same direction of the motion of the Modell and of the string that drew it; but not in the 2d case when the fore axis was so much lower then the top of the Pulley.

g Mech. c. 7. pr. 3. §. 36.

An Extract of the Journall of the Philosophicall Society of Oxford; giving an account of a large præternaturall Glandulose substance, found between the Heart and Pericardium of an Ox.

Novem. 4th 1684.

THAT Lump of Flesh, taken out of an Ox, and seen by this *Society*, the last Week; having been examined, by severall of our Members, afforded the following Observations.

The weight of the whole substance, cleared from the little Fat, &c. adjoining to it, amounted to $19\frac{3}{4}$ *l*.

As to its figure, it so far resembled a *Heart*, that it was along time taken for nothing else; but it was something flatter, than the *Heart* is naturally; each of the flat sides making an equilaterall Triangle.

The *Basis* of this *Cone* of flesh was 2 foot 7 inches in Circumference: a thred drawn round it lengthways, from the *Basis* to the *Vertex*, came to 2 foot, 9 inches.

We then divided it, cutting from the *Vertex* to the *Basis* of the *Cone*; and passing thro both the *Ventricles*, and *Mucro* of the *Heart*; by which means we saw the *Heart* not to exceed the naturall size; that which was extraordinary about it, being a large *Glandulous* substance compassing the *Heart* (unless where the Vessels had their passage,) and stretching the *Pericardium* to the excess before mentioned: We saw no Liquor in the *Pericardium*, nor indeed was there room for any; this *Glandulose substance* taking up all the space between the *Heart* and *Pericardium*, to both which it grew very fast.

This præternaturall substance was thickest about the *Basis* of the *Heart*, where it covered the *Auricule*, and was
three

three inches and $\frac{1}{5}$ of an inch thick; it grew thinner on both sides gradually toward the *Mucro*; where it was one inch and $\frac{1}{2}$ thick.

In the *Septum Cordis* a gritty Sabulose substance was found, half as big again as a Walnut.

In the *Lungs* were severall *Cystides*, containing matter more or less fluid: one very larg *Cystis* held some ounces of a matter not unlike that of a *Steatoma*.

The Butcher who killd this Ox, says, the *Lungs* grew fast to the *Pleura*, on both sides; which He affirms not to have found once in forty times, in the Cattle killd by Him.

He says also, that the Ox, tho not overburthend with Fat, complaind much in travailing; which is easy to account for, there being not room for the *Heart* to be distended, as it ought, in its *Diastole*.

De ORIGINE FONTIUM Tentamen Philosophicum,
 in Prælectione habita coram Societate Philosophica
 nuper Oxoniæ instituta ad Scientiam Naturalem
 promovendam, . Per Rob. Plot LL. D. Cu-
 stodiæ MUSÆI ASHMOLEANI Oxoniæ Præ-
 positum. & REGIÆ SOCIETATIS Secretarium
 Oxon. in 8°. 1685.

THE *Author* of this *Treatise*, de *Origine Fontium*,
 disliking the old way of handling this *subject*, as
 too general and remote; has chose rather to argue for
 both parts of the *Question*, from the *History* of *springs*;
 with intent more particularly to satisfy his *reader*,
 which *springs* they are, that wholly come from *rains*,
mists, *dews*, &c. which from the *seas*; and which from
 both. In order hereunto (after a short *Proem*,) He gives
 us a *Scheme* of the several *species* of *springs*, to which he
 thinks all what ever may be reduced: and then pre-
 sently determines that such *intermitting springs* as are
 profluent after *rains*, and then gradually slacken, and
 at last are wholly dryed up upon heats in the Summer, doe
 certainly owe their birth to *rains*. And not only such in-
 termitting ones, but some *perennial springs* too, such as we
 many times find on the tops of Mountains, which we may
 rather term weeping, than flowing or running *springs*;
 which seem to have their Origin from the *mists* we so
 frequently see hanging upon the tops of hills. Yet He
 cannot agree with several worthy *Authors* he there men-
 tions, and whose Arguments he recites, that all *springs*
 owe their origin to *rains*, *dews*, &c. For he thinks not
 that *temporary irregular fountains* (whereof he enume-
 rates many,) can possibly come from *rains*; much less
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the temporary regular ones, such as the fountains of the *Loire* in *France*, of *Lambs-bourn* in *England*, of the *Zirchnitzer Sea* in *Carniola*, and divers others. Much less still thinks he that such vast perennial springs, as those of *Willowbridg* in *Staffordshire*, of the *Sorgue* in *France*, can come from rains; since he finds upon computation, that all the waters that fall near them for the space of a year in rains, dews, &c. will not comparably amount to what issues from them. For the better Calculation whereof, he shews to what height rain-water will rise in a year in a *Conservatory* fitted for that purpose *communibus annis*; and how many *French Muids*, *Hogsheads* and *Gallons English*, will flow out of a cubick inch bore, in 24 hours, in a year, &c. And then shews that though it may be true (what an Anonymous *French Author* asserts,) that more water falls in rains near the fountain head of the *River Sein*, than is needfull for the yearly expence of that River, yet it is not so at *Willowbridg*, or likely to be so with the fountain head of the *River Sorgue*, which as *Gassendus* tells us is navigable to the springs which are its original. Yet much less still can he imagin that all the rains, mists, dews, snows, &c. that fall upon the surface of the whole *Earth* for the space of a year, can supply the vast expence of all the *Rivers* in the *World* for the same time: when the *Volga* alone, according to the calculation of *Ricciolus*, pours forth as much water into the *Caspian Sea* in a years time; as will suffice to cover or drown the whole *Earth*: and so the *River Canada*, or of *St. Laurence* in the *West-Indies*. And if these either of them alone expend as much water in a year, as all the rains, mists, &c. seem capable of supplying; much more sure will the *Argyropotamus* or *Rio dela Plata* doe it, which says the same *Ricciolus* is bigger than the *Nile*, *Ganges*, and *Euphrates*, all put together; its Mouth being 90 miles broad, and running with that violence into the *Sea*, that it makes it fresh 200 miles forward. Or if

these singly will not doe it, certainly all three joyntly will, at least these and a thousand others must; which upon a modest conjecture, he computes must needs pour forth into the *Sea*, at least 500 times as much water in a year as falls upon the whole surface of the Earth in *rain, mists, snows, dews, &c.* in the same space of time. And as he judges that all *fresh-water springs* cannot come from *rains*; neither can he beleive either that *hot springs*, or *salt springs* are maintain'd thence. Nor thinks he it likely that *springs*, where there falls little or no *rain*, or where the *Conservatories* must needs be too small, as in the *Illes of Mago, Rotunda*, and the *Strophades*, the Rock whereon stands the *maiden Tower* in the *Thracic Bosphorus*, should be supplied from *rains*. Then he goes on to prove that there are subterranean communications between the *Seas* and *fountains*, by which they are supplied, and that there are *Charybdes* which swallow the *Sea*, which happening sometimes to be stopt, the greatest *Rivers* have ceased to run, as the *Thames, Trent, Medway*, in *England*; the *Elve, Motala, and Gulsfang* in *Sweden*; and sometimes being too much open'd, *fresh-water springs* have turned *salt*, as *Pliny* says it once happend in *Caria* near *Neptunes Temple*. This subterranean circulation of waters he further evinces from divers *springs* he there enumerates that *ebb and flow* with the *Sea*; and from divers *Lakes* that have *Salt water* and *sea Fish* in them, yet have no superterranean communication with any *sea*, such as the *Lake Haguygabon* in *Hispaniola*, the *Caspian* and *Mediterranean seas, &c.* He also says that 'tis further evident that there are such passages, from divers *marine heterogeneous substances* that have been found in digging deep underground, such as *shell fish, &c.* Where by the way he discourses of divers such *Indraughts* there are in the *sea*, more particularly of the *fluxus Moschonicus*, or *Maalstroome* on the coast of *Norway*, and beleives there must be some such vast *Charybdis* (beside that on the coast of

of *Sicily*,) in the *Mediterranean* which must swallow all the water which perpetually flows into it, otherwise it must need overflow the low land of *Ægypt*. For that an *undercurrent* (which some have beleived,) in the *straights-mouth*, will not solve this difficulty, unless occasioned by a vast *Gulf* that must be placed somewhere in the *Atlantic* near the *Mouth* of the *straight*, which though overflowed and hidden by that mighty sea, yet may possibly absorb the deeper waters, and so cause a contrary *undercurrent*. Thus having proved that the greatest *perennial springs* derive themselves from the *sea* through subterranean *ductus's*, from *Philosophy* and profane *History*, he next appeals to the *Testimony* of the *Scriptures*, where he gives a new *Interpretation* of *Eccl.* i. v. 7. and shews how agreeable the doctrine of the *Ancient Philosophers* is to the *scriptures*: And then proceeds to answer the cheif *Arguments* of those who hold, that all *springs* whatever come from *rains*, &c. Where by the way he shews, that there are *springs* upon the very *Tops* of Mountains, and that others rise in plain *Champion* Countreys, of both which he gives many instances. Then he shews how many ways *water* will ascend above its own *Level*, 1. by the help of *Hypogeal* heats. 2. by *Filtration*. 3. by the *unequal height* of divers *seas*. 4. by the distance of the *Center* of *Magnitude* from the *center* of *Gravity* in the *Teraqueous Globe*, where he indeavours to prove, that the *superficies* of the *Pacific sea*, is further from the *center* of *Gravity*, than the top of the highest Hill on the adverse part of the *Globe*. 5. by the help of *stormes*. And 7. he shews that *sea water* does ascend above its own *Level* by coming into *Wells*, whose bottoms ly higher than the surface of the *sea* next them, at highwater mark. Next he gives the *Method Nature* uses in making *sea water fresh*, and whence it comes to pass that the caverns through which the *sea water* has percolated for so many ages, are not stopt; and proves that the *springs* are car-

ryed in the Earth after the manner of the *Blood* in the *Veins* of *Animals*, from their not being found in all places indifferently. Lastly he shews how it comes to pass that the *sea water* after so many repeated *percolations*, for so many years, is not yet become *fresh*. That it has its *saltness*, from the *Rocks* of *Fossile Salt* intersperst in its bottome and shores, and how much inferiour it is in *saltness* to the *Mediterranean* brines. All which he has treated of with that modesty, that he sincerely professes, he shall readily retract any thing that he has asserted, whenever better informed either by his own or the more nice observations of others.

Medicina Septentrionalis Collatitia, *f. Rei medicæ nuperis annis à Medicis Anglis, Germanis & Danis emissæ sylloge & syntaxis. Opera Theophili Boneti. D. M. cum Indicibus & figuris necessariis. Geneva. M. DC. LXXXV. in Fol.*

THIS Author designing a body of the law of Nature, in imitation of that of the Civil Law, to his two former Volumes subjoyns this, the intent of which is to shew how much Physick owes as to its improvement to these Northern nations. The Instruments of which have been the *Royal Society of England*, afterwards copied by our neighbouring Nations; *Paracelsus* opened the way, and was followed by *Helmont*, *Harvey*, *Lower*, *Bartholin*, *Malpighius*, *Wharton*, *Willis*, *Betts*, *Schneider*, *Steno*, *Sylvius* and others, which are briefly summed up in the preface. The book is divided according to the usual partition of the body of man, into three parts. The first contains the diseases incident to the head, which is taken here intirely with all its parts, the hair not excepted, with observations about which he begins, for that even our hair is not without its diseases and those none of the least troublesome; the *Plica Polonica* is a sure and a sad instance, the Nature and the cure of which you have here discoursed of at large, as also its division into *male* and *female*. He brings instances of Monstrous births born without heads, one of which had its Eyes placed under its armes, on these *Schrockius* discourses whether they ought to be Baptized or not, bringing Authorities and reasons on both parts of the question, it being difficult to determine whether they have a rational soul or no. These are followed by Monsters in the other extream, such as have many heads, where another question arises *viz.* whether such are many Animals, or only one, or whether the soul be multiplied

when the brain is, that being the reputed seat of it. Next come those who have been Monstrous as to the shape of the head, several instances are given of the *affectus cornutus*, of the defect or excess of the *Sutures*; of several wounds of the head, some mortal, others beyond all probability of escaping, particularly that of the *Hungarian Captain*, who though he had a Lance struck through his head, yet lived many years after it, and fought often. In the diseases of the head and Nerves is inserted a discourse of *Olaus Borrichius* concerning the use of *Volatile Salts* in the distempers of the head, in which he asserts the difference of volatile salts, and prefers that of *Mans Skull* as the most proper in such cases; And among several sorts of pains of the head there is an account from *Joel Langelot*, of one which rose and set with the Sun, observing exactly the same degrees of increase and decrease, as the Sun did in its motion to and from the Meridian, &c.

In the affections of the Eys, the place and manner of vision is determined, together with the relation of the controversy between *Pecquet* and *Mariotte*, concerning the termination of the species, and vision the result of it, being performed rather in the *Chorooides*, than in the *Retina*. The famous experiment of restoring the humours of the Eys, was at last resolved into their natural restitution, from the same humours being replenish'd those wayes they are constantly nourish'd, and not from their being repaired by the injections of *Burhus*, or any other pretender.

The second book treats of the diseases of the mouth and breast, where among other things we meet with a discourse concerning an infallible way of preserving a man from infection though he converse constantly with all sorts of those who are infected, the way is no more than forbearing to swallow the *Saliva*, which at any ill smell is rais'd by nature, on purpose to be ejected, the suppositions that confirm this opinion are chiefly,
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the fermenting nature of contagion. This contagion chiefly propagated by *effluvia* in the Air; These *effluvia* are readily imbibed by the *Saliva*, which thus impregnated and swallowed, must needs communicate them to the body; to which may be annexed the observation of a Consumption cur'd by a critical salivation. He treats very largely of the nature and cure of a *Peripneumonia*, and of its difference from a *Pleurisy*; of all diseases of the lungs, as *Gangrene*, *Schirrus*, *Vomica* and *Stones* frequently found in them, a case of which latter is subjoyned of one who expectorating many of different shapes and sizes, was eased from a *dyspnœa* under which he almost mortally laboured.

Among *pleurisy's* there is an account of a periodical one returning once in seven weeks. Of another caused by laughing, &c. Among the celebrated remedies for it, you find *Antimonium Diaphoreticum*; as also a bark in India very powerful, if not a specifick in this case. It is called *Pavo de portada*, of a yellowish colour, bitter tast, and a friable consistence; half an ounce in a glasse of Wine is the dose. In his Histories of consumptions he relates an example of the great contagion of it, which was the infection of a senators second Wife, only by wearing the Muff of his first Wife who died of one, though after the distance of above a twelvemonth. He gives a particular account of the famous *Cnasselius's* remedies in this as he has done in other cases: Instances how *Opium* has been very unsuccessfully applied in it, death insuing the stoppage of the spitting, and the coagulation of the matter there caused by it.

In the Section de *Respiratione laesa*, there is a large dissertation de *halitu humano*, of its difference, causes, manner, quantity, use, diseases, &c. writtea by *Georgius Traneus*. Which discourse is followed by an account of a monster which breathed through an hole in the pole; as also the discourse of *Dr. Loner*, how a dog may be
made

made to breath as an Horfe does when broken winded, taken out of the English *Philosophical Transactions*.

In his third book are containd what concern the *Abdomen* and its parts, of which the *Oesophagus* being looked upon as the beginning, the preternatural cafes of that are first handled; such as its being turned to a *Cartilage*; being obftructed by different caufes, and the like; and after the account of feveral ways *deglutition* has been hindered by, the famous Hiftories of men swallowing odde fubftances come in, as mony, frogs, knives, fire, &c. But becaufe twould be endleffe to enumerate particulars, you have comprized in the whole volume, whatfoever this age and thefe Climates have produced curious in Medicine. And what are fcatter'd and lye confused in *Ephemerides*, and other trafts, (which the learned now publifh their particular obfervations in,) are here collected into one book, digefted into heads, and the Authors name annexed to each relation, to fecure the propriety to the firft inventor. And though little feems to be wanting in this volume, yet the Author not thinking he can doe too much good, promifes a fecond then in the preffe, when this was firft publifhed.

Johannis Nico-

Johannis Nicolai Pechlini Med. D. P. serenissimi Cimbriæ Principis Reg. Archiatri, Theophilus Bibaculus, sive de Potu Theæ Dialogus. Francofurti; Quarto, 1684.

THIS tract, written by the way of Dialogue, gives us an account that *Thee*, or *Tsia*, is a shrub growing in most parts of *China* and *Japan*; it arises generally to the height and bigness of our Garden Rose and Currant Trees; the Roots are fibrous, and spread into many little filaments, near the surface of the Earth; the flowers are like those of *Rosa Sylvestris*; the Seeds round, and black; which being sow'd come to perfection in three years time, and then yield an yearly crop; but these are passed by, as not much material; the great and only Vertue of this plant being supposed to consist chiefly in the Leaves; of which there are five sorts, both as to bigness, and Value; for the largest at bottom are sold for about penny halfe penny the pound; the smallest at the top for 50, sometimes 150 Crowns.

As to their figure, they are thin, narrow, sharp pointed, and indented on each side, which some have compared to the *Consolida*, the *Bellis*; Others to the *Paliurus*, and some again to the *Myrtus Brabantica*, or *Chamaleagnus Dodonæi*; But our Author not liking the comparisons, nor much solicitous about them, comes presently to the Vertue of *Thee*, and endeavours to shew how far it agrees with some plants of our own growth, as to the effects it produceth.

Thee then is hot and dry; of a bitter adstringent
F Quality;

Quality; the Infusion of it gives a green Colour; but upon the mixture of the solution of Vitriol, it turns black; whereas *Chamadrys* tho' bitter, is not astringent; and upon such mixture grows green, rather than black. *Cardiaca*, and *Marrubium* give a very deep Tincture, but grow not black with Vitriol.

Sanguisorba well enough resembles the Colour, but the tast is by no means, so smart, and brisk.

The *Myrtus Brabantica* gives a lively yellow Colour, but changes very little with Vitriol.

Veronica comes nearest to it, for it gives a good tolerable Tincture; and tho' the tast be not bitter, yet 'tis extremely astringent; and not only soe but it turns black alsoe, like *Thee*, when mixt with the solution of Vitriol; neither doe it's effects come far short, since it cleanses the Kidnies, and very much strengthen's the head, and stomach. This Plant abounds with a brisk Volatile salt, which he adjudges very agreeable to our Northern Constitutions, whose blood is naturally very heavy, and sluggish; it carries alsoe with it a fine thinner sort of Oyl; but soe admirably well temper'd, that as this hinders the spirit from Evaporating, soe that corrects the Inflammability of this; from whence results the very agreeable bitter astringent: All which together, as they rectifie the ferment of the blood, and at the same time strengthen, and confirm the tone of the parts, contribute so much to the assisting of Nature in her Operations, as to prevent, if not to Cure, most Chronical Distempers. But because the discreet choice of a proper Vehicle or Menstruum, for this great *Panacea*, may be very material, he thinks good to shew his dislike of Broath, and Milk; in that they obtund, and obstruct it's more lively and quicker parts; but the latter more especially; as all ways leaving behind it much acidity, which how prejudicial to *Hypochondriacal*

driacal persons, is left to the Learned to determine, He dislikes the custom they use in *Japan*, of drinking the leaves powdred, supposing that it may dry the body too much, &c.

He concludes warm water to be the most natural, and effectual Vehicle, as being pure, and void of all saline or otherways pernicious particles, and being more ready to absorb, and be impregnated with the Vertue hereof; which when armed with this powerfull Vegetable, Nature easily admits into its obscure channels, and dark recesses; and by this means it is, that it subdues those stubborn Humours, which are never more effectually rooted out, then (as they came in,) by degrees, by Custom, and Habit.

He approves well enough of the use of Sugar; as it serves not only to qualifie the bitter tast, by its sweetnesse which at the same time is Corrected by the Heat; but as being good alsoe for the Kidneyes, and Lungs. He thinks the difference of constitutions too great to be insisted on, and therefore only says this *viz.* that those of a dryer Habit may take it more diluted, because their salts may more easily be carried off: and for the Moister and Hydropical temper He supposes this Water, if more strongly impregnated may make way for the Evacuation of the other.

As to the times of taking it, the more empty the Stomack, the passage will be the more easy, and therefore in such the more effectual: He condemns the use of it after meals; because the Volatile part flies off, before the meat is any ways digested; after which the Concoction is difficultly performed; because the ferment, as well as the Volatility of the Chyle, is suppressed by the Astringent Quality; which in those Circumstances oft proves

a thing of very ill consequence. To conclude, our Author notwithstanding all his Encomium's of this Exotic, can be content to think, we might receive as much Benefit from some plants of our own growth; were People Industrious to search after them; some of which are *Veronica*, *Lingua Cervina*, *Marrhubium*, *Hepatica*, *Cichoreum*, &c.

F I N I S

Errata in the Transaction of December last.

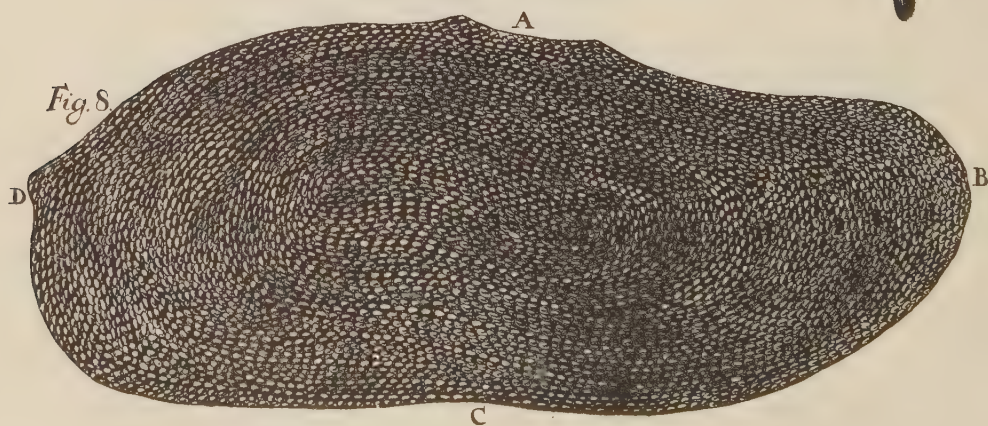
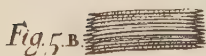
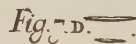
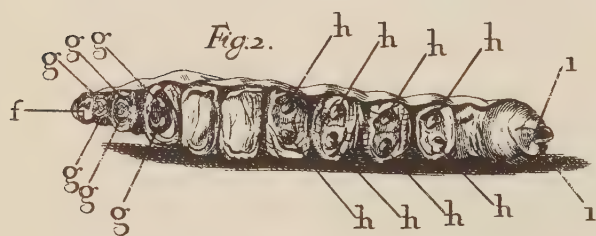
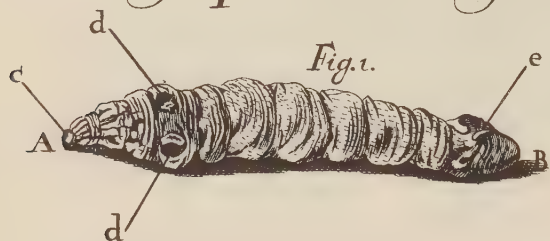
P Ag. 814, line 8, within the Parenthesis read thus (*which, with the other small Guts, and Stomac, was very much distended with the matter of the last meal:*) pag. 815, lin 14, for *musculoſe Veins*, read *musculoſe and membranose Tunics*. pag. 816 line 21, for *Meat* read *Meal*. Pag. 817. line 21 read *Musculoſe and membranose Tunics*.

Errata in the Transaction of January.

P Ag. 840, line 5, for *pommand*, read *command*. pag 841, line 2, for *Dſigned*, read *Deſigned* line 10, read thus *1684, forty*. pag 145 line 6, for *gg gg* there ought to be *GG GG*; line. 9, for *bbbb* there should be *HH HH*. pag 848, line 1, read *urpoic*: line 3 read *AA* Fig. 61b. pag 855, lines 3 and 4, for *oever*, read *over*: line 4 read *driven*: line 22 dele after.

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Philosoph. Transact. Number, 168



MBurghers sculp.

PHILOSOPHICAL

TRANSACTIONS.

Feb. 23^d. 168⁴.

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A Letter from William Molyneux Esq. Secretary of the Philosophical Society of Dublin, to a S. of the R. S. giving an account of the Connough-Worm.

I Here send you inclosed the figures of our Connough-worm, which is reported to be the only poysonous Animal in our Kingdome ; but whether it be really so, or not, I cannot assert on my own experience. That from which the figures were taken, was sent alive to me, from the Country, about 40. miles from Dublin. The Gentleman that sent it, had kept it above six weeks in a large Box on a Grassy sod, now and then giving it a fresh sod, and Ragwort to eat, besprinkling them with Dew. Before I could get the figures taken, the creature was so unquiet, I was forced to stifle it, as Huswives do their Bees, with the fume of sulphur. When the Gentleman first took it, it was much smaller then when he sent it to me ; And had I been at the trouble of keeping it, it might have been yet much larger ; some of them being as thick as a Mans thumb, and above three Inches long, and some live so long as to have fine hair thinly dispersed over their bodys. Immediately upon my receipt thereof, I writ to the same Ingenious Gentleman that sent it me, proposing some Queries to him concerning it, the chief whereof were, whether he had any certain Experiment to prove them Venemous? What Symptomes attended the Beasts affected by them ? And what cures were applyed to them ? To the first, his answer was to this effect, that he had consulted the experienced People of the Country, who all agree in asserting the Animal poysonous, but he knew none that had made a satisfactory experiment thereof, none being able to say they
ever

ever saw a beast eat it, or stung by it. And yet for his own Opinion, he was apt to think, that the Animal was pernicious, if eaten by a beast. For first, the disease imputed to this Creature seldom or never affects the Cattle but in Autumn, and then only this Insect is to be found; secondly it seldom or never attends any Cattle but what feed in low Marshy grounds, and there only this Animal frequents; Thirdly Cows who are greedy feeders by great Morfells (by reason of their chewing it afterwards in their Cud,) but especially Swine that feed in low grounds, are the only Creatures troubled by this Worm; Fourthly, the Worm is very rare and scarce to be found in seven years, and so likewise is the distemper that proceeds from it, it being rare to have a Beast affected by it. As to the symptoms that attend its Venome, they are swelling in the Head, and (as a peculiar Characteristick, the swelling and *Procidencia Ani*, insomuch that the *Rectum* will hang out above half a foot. The effectual cure applied to this Malady in black Cattle, is a Drench of the Herb Bears-foot, Rue, Garlick, butter and beer; but for Swine, Raddle pounded small mingled with Buttermilk. These only are used by the English Husbandmen. But the Irish, as they certainly impute the Malady to this Insect, so they draw the Remedy therefrom; for they assert, that if an hole be bored in a Tree, and this Creature stopt up therein, so as to starve and dye, the leaves and bark of that Tree ever after infused in water, and given as a Drench, cures the affected Beast; and severall will repair to such a Tree ten miles for a cure. Another fancy (& as ill grounded,) they have, that if a Man bruise this Worm between his hands, and let the expressed juice dry thereon, ever after the water he first washes in, in the morning, given to the Beast to drink, cures it. And the Worthy Gentleman that sent me the Worm, tho' he be far from giving credit to the cure, yet for the satisfaction of his poor Neighbours, did severall years ago

bruise one of these Worms in his hands, and ever since he has been often applyed to from severall parts of the Country for his Virtue, and the People go away well satisfied, assuring him (when he asks them afterwards,) that the Remedy proved very effectuell on their afflicted Beast.

But that I may give you my own sentiments, I am very apt to suspect that this Worm is no more poyson then other Catterpillers (for 'tis of the Catterpillar kind,) and I believe, in *Godartius* of Insects, lately englished by the most learned and ingenious *Dr. Lister*, you will find the very same Animal as this I speak of; but at present I have not that book by me, having sent it to my Brother in *Holland*. I never had, or have seen, but this one, and so I would make no experiment therewith, being forced (as I told you,) to kill it. But I verily believe that the Uglinefs of the Worm (it being of a dark fuscous, and as they say, poysonous colour,) together with its largeness beyond common Catterpillers, has wrought so upon the fearfull and ignorant Vulgar, that they have given it the name of Venemous. As to the Gentlemans forementioned Reasons, they are but conjectures, and as such I submit them to your judgment; and my negative opinion has much the same foundation, for I find the People of our Country much in the wrong in some particulars relating to the Animal, which makes me suspect they may be in an error relating to its poyson. For first tis commonly asserted by them, that the two spots marked *dd* Fig: 1. are Goggle Eyes, whereas they are nothing more then two Variegated spots of a colour different from the rest of the Back. Secondly, they assert likewise, that the part marked *e* Fig: 1. is a sting, whereas this Protuberance in the Tail is common with it to severall other Catterpillers, and the greater the Catterpillar, the larger this Horn. So that if their fear or abhorrence of the Worm may make them believe those parts

parts Eys that are not, and that part a Sting, which is not at all like it, contrary to the plain View of the Creature; It may likewise make them imagin it poysonous, when it is no such thing. But yet I will not conceal what I have from another Gentleman (but with some diffidence of the Experiment,) he gave the juice of one of these Worms to one Dog, which shewed no alteration thereon, but another Dog, to whom he gave the skin of the Creature, was found dead three dayes after; but whether his death proceeded from the poysonous skin, he could not assert; for the Dog ran at liberty, and might have been kild (for ought as he knew,) by some other Accident, tho' no externall sign of any Violence offer'd to him did appear. But leaving these conjectures, I come to what is evident to the senses (and experimental Philosophy ought to go no farther,) the explanation of the Figures.

Fig. 1. *AB.* the Worm lying on his Belly, long $2\frac{1}{2}$ Inches almost. *c.* his head. *dd.* two Variegated spots mistaken for Eyes. *e.* a small Protuberance towards its Tail, from whence arises a part in shape of a horn, mistaken for a Sting.

Fig. 2. Represents the Worm Reclined almost on his back. *F.* His mouth formed like that of other Catterpillars, as appeared in the Microscope. *gg.* &c. six small horny feet or Claws, 3 on each side, as in other Catterpillars. *hh.* &c. Eight *Papillæ*, with which he fastens himself to what he goes or hangs on, as Childrens suckers are fastened to wet stones.

ii. Two larger *Papillæ*, with which he does both suck himself fast, but most commonly therewith he grasps the stems of Grass and Herbs, to which he clings with the other.

P. S. Since the writing of this Letter, I have again seen Godartius of Insects, and in him I find, (as I surmized,) our Connought Worm, described by the Name of the Elephant Catterpillar, Numb. 125. or 126

Yours Will. Molineux.

H

Part of

Part of 2 Letters from Mr. Thomas Molyneux concerning a Prodigious Os Frontis in the Medicine School at Leyden. Dec. 29th. 1684. and Febr. 13th 168^r;

I Herewith send you an Account of a prodigious large *Os Frontis* which I my self have seen, and measured according to the English Inch; 'tis reserved among severall other bones, and sceletons, that belong to the Medicine School, here at *Leyden*. And I take it to be the more observable, by reason, that altho' I have seen severall bones, of very large size, that were said to have been of Giants; yet I never was thoroughly satisfied, they really were so; imagining them only to have belonged to some other larger Creature, then a Man, whose bones for the most part, excepting those of the head, do not much differ from those of other Animals. But this being an entire *Os Frontis*, compleat every way, and differing in no respects from that of a Mans, but in its largeness; and since there's no Creature, especially of the larger sort that has this bone at all resembling ours; there's not the least Question to be made, but this formerly belonged to a Man, and that of a most extravagant large size. Its dimensions were as follow; from its juncture with the Nasal bones, to the place where the *Sutura Sagittalis* terminated the Convex way, 'twas 9 Inches $\frac{1}{5}$; transversely from side to side, still measuring the Convex way t'was 12 Inches $\frac{2}{10}$; in thickness about half an Inch. I have measured this same bone in severall ordinary Skulls, according to all these Dimensions, and find that one with another, they scarce answer it in half proportion; for where it was 9. Inches $\frac{1}{10}$, they are but 4 Inches and a half, and where it was 12 Inches $\frac{2}{10}$ they are not above 6, and

and in thickneſs not above $\frac{1}{4}$ of an Inch . Now arguing that this bone bears that proportion to his ſtature, which the ſame in other Men does to theirs, it muſt follow that he was more then twice as tall as men uſually are ; and according to the moſt moderate computation, ſuppoſing the height of a Man to be no more then five foot 6 Inches, he to whom this bone belonged, muſt have been at leaſt more then 11 or 12 foot high, a prodigious height for a Man, and ſuch as ſome will ſcarce allow ever to have been, *Sed ex Fronte Herculem, &c.*

Part of another Letter relating to the ſame ſubject. As to the Quære concerning the bone, I cannot ſatisfy you; were there any Account to have been got of it, I had certainly ſent it you before: it has been kept here theſe ſeverall years; and the preſent Profeſſor of Anatomy Dr. *Drelin-court* once told me, he found it among the reſt of the bones and Skeletons, when he firſt came into that place, but never could learn who gave it, where t'was found, or whence it came. That there are ſome whoſe heads are very large in proportion to their Body, cannot be denyed, yet generally ſuch Skulls want in thickneſs (as this does not,) are ill ſhaped, and not proportionable ; and moreover I'm perſwaded there never yet was an Inſtance of any head, which by a præternaturall growth, came the leaſt nigh this for bulk ; and as I conceive, 'tis far more probable, and eaſier to allow, that a Body bore this head which was proportionable to it, then that it belonged to a Man of ordinary ſtature ; who in this particular, would certainly have been in one ſence, the greateſt Monster the World ever ſaw.

*An account of a Stone grown to an iron Bodkin in
the bladder of a Boy: communicated by Dr. Lister
Fellow of the Royal Society.*

FIG. 3 represents a Stone which was cut out of the bladder of a Boy at *Paris* by *Monfieur Colo*: the iron bodkin, to which the Stone grew, and which passes through the middle of it, had been thrust up into the bladder by the boy himself, about two years before the incision. The Stone was presented by the above named Chirurgeon to his late Majestie of *England*, amongst whose rarities it is now preserved, and by whose favour and permission I caused this draught to be made of it.

An Abstract of a Letter of Mr. Anthony Leewenhoek Fellow of the R. Society; concerning the parts of the Brain of severall Animals; the Chalk Stones of the Gout; the Leprosy; and the Scales of Eeles.

HAVING lately been employed about the Eyes of Turkey Cocks, I proceeded to examine the Brain; and tho' in my Letter of the 14th. of May 1677, I have already treated of that subject, I shall take no notice thereof, but lay down my Observations I hope more distinctly and substantially then before.

I first took in hand the *Cortical* parts of the brain of a Turkey Cock, these parts (a great number of small blood Vessels and small Globules excepted,) consist of a very clear CrySTALLINE Oily matter, which for its transparency ought rather to be named *Vitreous* then *Cortical*. When I separated a little of this matter from the rest, there flowed from the place (tho' it spread less then $\frac{1}{16}$ th of a hair,) a little thin moisture, containing in it some extream small Globules, less then $\frac{1}{30}$ th part of one of those which make the rednes in the blood. It is to be noted that this fluid matter, was cheifly in the brain of such Turkeys, as had been dead for some time. It is also not improbable, that a part of this moisture might flow out of some of the small Vessels, or that some of the very minute Vessels might have been turned into a watery substance.

Besides the above mentioned small Globules, there were also some about the bigness of $\frac{1}{2}$ th of a Globule of our blood. These two sorts I conceived might have come from small Vessels which by chance I had broken, being made out of the grosser parts of the fluid, at the time that the humours grow cold and stagnate.

Together with the above mentioned Globules, there

were some transparent irregular ones, as big or bigger then a Globule of our blood, which lay among the branches of the blood Vessels, in a space no bigger then a course sand. Many of these blood Vessels were so small, that if a flat ovall particle of blood (which causes the redness therein,) being supposed to be perfectly Globular, were divided into 500 parts, yet could not one of those parts pass thro' their Cavity's, without being more divided and fitted to enter them. For if the wideness of the Cavity, be as 1. the Diameter of the Globule is as 3. and consequently the proportion as. 1. to 512.

Tho' these blood Vessels were so small, as is before said, they had notwithstanding such a degree of colour, that I could discern the matter in them, to be that which maketh the blood red. And I was further confirmed in my Judgment, by observing that other blood Vessels, which were some what thicker, appeared proportionably higher coloured, and more inclining to red: and that the redness appeared more plain, when 3 or 4 Vessels lay immediately one over the other, without any other matter intervening.

The cause of the brownish colour of the *Cortical* parts, I take to be the great number of Veins and Arteries, which run thro' the transparent substance, whereof these parts chiefly consist. To which may be added that there were severall particles mixt about as big as $\frac{1}{8}$ of a blood Globule, which were not transparent. We may perceive that the *Cortical* parts in many places enter deep into the *Medullary*, but if we diligently search into them, we shall find them as full of blood Vessels as the outside.

Besides the aforementioned very thin blood Vessels, there are other Vessels in the brain, so thin, that I conceive a round body (as aforesaid,) altho' divided into above a 1000 parts, could not pass through them.

Tis to be noted that in these Observations, are mentioned only such blood Vessels, which are as thick or thicker then a hair of my head. But

But to come to the *Medullary* parts of the brain, therein were contained irregular Globules of different sizes, some of which were of the bigness of a Globule of our blood, and some larger, seeming to consist of a thin transparent Oyl-like substance; these are here in such numbers (chiefly where the *Medulla spinalis* beginneth,) that they seem to compose the greatest part of the brain. This great number of transparent Globules, causes a white colour (for all transparent bodies, which are not so united together, that the Ray of light can in a streight line pass through them, and so make them as it were one body, must produce to our sight a white colour, as I have formerly often said,) these irregular Globules, were yet so fast joyned the one to the other, that (when I had layd them very thin, or single before me, and endeavoured to separate them,) some would be drawn out to twice their naturall length, and then seemed to me, as if they were kept together by netlike threds. This made me think, that the smallest branches of the blood Vessels might incompass these Globules, as we find the small Horizontall Vessells, in some kinds of Wood, give way to the great perpendicular Vessells, and wind half about them. And I was confirmed herein, when I perceived, many of the foresaid Vessells, appeared clear in the middle; and brownish on both sides; but more brown, when I had torn the Globules asunder, and lay'd the thin thred-like parts by themselves.

In fine the *Medullary* parts of the brain, appeared often like a fishers net, between each of whose Meshes, was placed a very plyable ball-like substance; which changed its figure into round or Ovall according as the said Meshes were stretched one way or other. Moreover the said *Medullary* parts consisted of a very great multitude of very small Globules, and some clear thin matter, which last, I also Judged, to have flowed out of the Vessells, that were broken, as also, that some of the Vessells, might have been turned into a Watery substance. I

I observed also the brains of a sheep, and perceived in the *Cortical* parts, a very great multitude of extream thin blood Vessells, containing some of the substance, which maketh the redness of the blood; whereby the Cortical parts become of a brownish colour.

While I viewed the incomprehensible number, of these small Vessells; It was very delightfull to me, to contemplate how every one of them, spread it self into severall branches.

There were also a great number of Globules not so transparent as others that were neer them, and that were in size as $\frac{1}{2}$ of a Globule, which maketh the redness in the blood: these I Judged to have been extravasated, by the tearing of the Vessels asunder, and to have been fix of them compounded together, when the Vessells were wide enough to carry them; but when the Cavities were so small, that they could not pass thro' them, they then broke into lesser parts, and lost their colour.

For the better representing the inconceivable thinness of the blood Vessells, I made the following Calculations. *viz.* 100 red Globules lyeing side by side, do not equall the Axe of a Sand; let then a Million of them be equall to its solid content. There are blood Vessells in the brain, which I judge $\frac{1}{64}$ part of a blood Globule would be too big to pass thro'; so that the Diameter of the Vessell, is to that of the Globule, as 1. to 4, and if a course Sand be divided into 64 Millions of parts, 1 of the parts (if it be stiff and unplyable,) will not pass thro' one of the smallest Vessells of the brain.

To proceed, the *Cortical* part of the brain, was constituted of such a cleer and Glas-like substance, as I have above mentioned; only with this difference, that it had white streaks or lines, thinner then a hair of my head, which to the naked Eye were invisible. These I judged to be occasioned, by a more then ordinary number, of very transparent great Globules layd together. I have
also

also perceived, brown streakes running thro' the *Medullary* part of the brain, which were only caused, as I conceive, for that there were but few, or none of those transparent Globules, there placed.

I examined some of the parts, which lay neer the beginning of the *Medulla Spinalis*; and I sometimes thought, I had found out a thing that I was doubtfull of, in the brain of a Turkey: *viz.* That the great transparent Oyl-like Globules, were, as it were surrounded, with an innumerable quantity of extreme thin, and net-like Vessels or streakes, mixed with some thicker Vessels, which lay in a line, and excelled in transparency, causing thereby, where they lay in numbers together, the brain to appear very white: these were in thickness about $\frac{1}{25}$ th part of a hair or something less. The other substances were little differing from what I have before mentioned in the brain of a Turkey.

Afterwards, I carefully examined the brain of an Ox, and satisfied my self, that the *Vitreous*, and very transparent matter, which makes up most of the *Cortical* part, consisted of nothing but extreme thin streakes or Vessels, which were neerly joyned together: but at another time, I could not to content, assure my self concerning the same. As to the remaining substance of the *Cortical* parts, I could discern no difference, from the brain of other Animals; but that there was not such a Quantity of fluid matter, as in Animals which had been longer dead. I found also the *Medullary* substance of the brain, to be such as I have before mentioned in a sheep: for it had very white streaks, in the parts from whence the *Medulla Spinalis* taketh its rise: this extream whiteness, was from several very transparent Vessels, which lay next one the other, and seemed to me, only made to carry the matter, by which, the *Medulla Spinalis* and Nerves, are partly nourished and maintained. The greatest of these last Ducts, (by guess,) was about $\frac{1}{155}$ part of the thickness
I of

of a hair of my Beard ; but at other times, I have discerned them thicker, and according to all likelyhood, I here met with a place, where these transparent Vessels were thinnest. In all these my Observations, I pass by many blood Vessels, which are visible to the naked Eye: for they are to appearance, like whole Rivers; whereas the other smaller Vessels, of which I have before spoken, seem, but like small Ditches or Channels.

I have also examined, the *Vitredus* or transparent parts of the brain of several Sparrows, immediately after their being killed; and have therein, not only clearly discern'd, a great number of small blood Vessels, as in a Turkey; but as plainly, as in an Ox, or sheep. Also the other parts, of the brains of a Sparrow, were very near of the same bigness, with those of an Ox: there being no other difference (the great blood Vessels excepted,) but, that these consisted of a greater number of the same parts. There were also, in the *Cortical* parts, an incredible number of extream small Vessels, lying so close to one another, that by reason of their transparency, they look't like Glass. The smallness of these Vessels, I have so often measured, that I have no scruple remaining: nor will any one else doubt, who considers, what the Organs must be in Insects, or what proofs thereof, we have within ourselves. For, as I lately anatomized the Eye of a Man, I compared a streak or Vessel, I found in the *Choroides*, with the Axe of a course sand, that was $\frac{1}{35}$ th of an Inch, making upon my Scale 330 Microscopical parts, now 8 of these streaks, lying by the side of one another, made but $\frac{1}{330}$ of the Axe of the sand, so that the foresaid Axe, is 2640 times broader then the streak. This number 2640, multiplyed Cubically, to finde out the solid content, it will make out, above 18 thousand millions: so that a cours Sand, as before is said, ought to be divided, into so many thousand million parts, before it could pass so thin a Vessel.

The

The *Medullary* parts here, consist chiefly of very small *Arteries* or Vessels, together with many small blood Vessels; as in the rest of the brain: otherwise they differed little, from the same parts of an Ox, Sheep, or Turkey; as I have before described them, only, the transparent Oyl-like Globules, were not so large, but, when I observed the brain of a Sparrow, which had been 24 hours dead, I saw the transparent Oyl-like Globules, as great, as those in the brain of an Ox, or other Animals. From this last, and other Observations, I have been considering, whether this great number of clear transparent Globules, might not, when the Animal was alive, have been designed to feed the *Medulla Spinalis* and Nerves: tho' now that Animal is dead, and the humours cease to flow; the particles that touch one another, congeal into figures of different sizes: For the blood that is carryed by the Artery's, into the *Cortical* part of the brain, does not return thence, by the Veins, but is prepared in the *Capillary* Vessels, till it be fit for the nourishment of the *Medullary* parts.

This may seem strange to some, who might object that because of the redness of the blood, the brain ought to be reddish of colour; but that followeth not; for the green Globules, of greenish slegm or snout, are truly blood Globules, which have changed their colour, being still of the same size with them, and consisting each of 6 distinct Globules, as they doe: and I conclude that as these are changed, from red into green, that also, as likely the red may loose their colour, and become white; especially when they are divided into very small parts as they must be, before they pass into the *Capillary* Vessels.

I have lately examined the Chrystalline humour of the Eye of a Man, that I might know, whether the small threds of the Scales, wind about in the same manner, as I have formerly described them, in the Eyes of beasts: but I could not discern the true constitution thereof,

notwithstanding I have twice, and at two distinct times, endeavour'd it. This I observe, that the Chrystalline humor was not fine, and cleer, but yellowish, whereby it differed from the Eyes, which I had formerly seen of other Animals.

I have read the Book of Dr. W^m. *Ten Rhine*, out of which I cannot but note, that the said Dr. agrees with my Observations concerning *Moxa*, written the 14th of May 1677. namely that *Moxa* is no artificial preparation of the Choicest Herbs, made by the Chineses and Japoniers, as H. *Buschhof* affirms, in his Book of *Moxa*, pag 52. 'Saying, none of all the Druggists of Europe, have 'any knowledg of the manner of preparing this *Moxa*; 'and by those of *China*, this Art is of such esteem, that 'they will not for any money, discover it to a Stranger. But my opinion is, that *Moxa* is only a production of a fruit, like the downy substance about the Peach, the Quince, and suchlike: and Dr. *Ten Rhine* holds, that it is a Wooll, of some leaf. I related also, in my fore-mentiond letter, that I had made tryall of the burning of the *Moxa*, on my hand; what difference there was between that and Cotton, what may be the reasons why the Chirurgeons esteem Cotton fiery and churlish, why it hurts a wound, when a band is made therewith, viz. because the hairs are flat, and have sharp edges or sides.

I have tryed many other Woolly substances, which grow on some leaves and fruits, in what manner they burn, and chiefly the Woolly substance which the Poplar Tree sheddeth; which Wooll, I had a conceit, when I had view'd it with my naked Eye, that it would burn quick: I had also the same Opinion, of the Woolly substance shed by the Willow Tree, in the beginning of June; which last, in the tryall excelled that of the Poplar Tree. But I have yet met with no Woolly substance, growing with us, which burneth so well as Cotton; and those, who with

us, undertake to cure the Gout, or any other disease, and have no *Moxa*, I would recommend to them Cotton.

I have also tryed the tinder of burnt linnen, but this burneth more fierce, and deep at once, then would be done at 10 times, with *Moxa* or Cotton.

A relation of mine, much troubled with the Gout, has his heel spoyl't with the great quantity of Chalk, that breaks out of it; this matter I examined in my Method, and separated the same in 3 parts, the first was the dryest, and whitest, made of small irregular parts, as if some small sands lay together; these thro' the Microscope appeared very dark bodies, and each of them consisted of a great number of long transparent figures; which I can liken to nothing better, then to cut Horse-hair, some thing sharp at both ends. These figures I judged so thin, that more then a 1000 of them lying close together, would not make out, the thicknes of a hair of our head: I have represented some of them, that their proportion in thicknes, to their length, might be comprehended, as Fig. 4. *A*. I have also found that these parts lay in very good order, one by the other, as in Fig. 5. *B*. and sometimes 2, 3, or 4. and more in length: I have often separated these small sand-like parts, one from the other, and again divided each of those parts, and then, I have not only seen, the figures which constitute the white matter, as Fig. *B*. but for the most part, in a confused order, as Fig. 6. *C*. I have also seen some of these figures so short, that some of them were in length but $\frac{1}{2}$ of Fig. *A*. and some but $\frac{1}{3}$, yea $\frac{1}{4}$ thereof, as here Fig. 7. *D*. but I conceived this was not their true length, but, that in the handling, they had broken. Among these figures, lay some irregular parts, which were again constituted of Particles, which I judged, had been Globules of blood, and had here in pressing, bin broken or bruised; As also many roundish parts, which I judged, had been $\frac{1}{5}$

of a blood Globule : also some small roundish particles, which I judged so small, that 36 of them, would constitute but one Globule of blood.

The 2d sort of this Chalky matter, not so white as the former ; contained the forementioned irregular parts, of long figures, in a very tough cleer matter, mixed with blood Globules, and very many of the forenamed small roundish parts.

The 3d sort, was to the naked Eye, somewhat reddish; caused by the many blood Globules, mixed, throughout the slimy matter in the Chalk : It was also constituted of the beforementioned roundish parts.

Altho' with us the Hospitals (of the Lepers,) are in many places ruined, or converted to other uses; and some learned Persons, maintain, there is here no such incurable Leprosy ; there are notwithstanding, at Harlem, Searchers appointed, to visit such Persons, as repair to them, pretending to that disease; who have power to grant men a sealed Certificate, and a Clapper, whereby they are authorized, to beg their food, for 4 successive years; after which time, they must be again reviewed.

I inquired of one of these licensed Men, wherein his disease consisted, and he shewed me his head, which was all covered with a skin, that scaled off, and red dry scabs: these scabs I guess to be caused by his scratching, or rubbing the part that itched, till the blood came, which blood afterward's dried upon the place. This Person, as he said, had his body whole and sound.

Another of about 36 years of Age, had all his head and face sound, and his head covered with black thick hair; but he said, his whole body (part whereof I saw,) was beset with great and small, white and red splotches, and also red scabs: the white splotches, were places from whence the scabs, of their own accord scaled off; the red scabs, were caused as before, by the hard scratching

ing of the place, which caused the blood to issue out, and which dried thereon; as the infected person also acknowledged. This person had been undertaken to be cured by 3, severall men; the first, pretended to do it by Salves, but without effect: The second, by blood letting; which he reiterated so often, that the Patient was much enfeebled thereby, but had no benefit; the third, who pretended great skill, purged him so often, that he became much weakned thereby; and was rather worse: so that in the end, he was fain to repair to Harlem, for a Licence to beg. I caused this man to scratch gently some of the scales off from his leg, which I preserved in a paper, and afterwards observing them, I found that in many places, they were beset with small parts of dried blood and matter. A 3d person, whom I met, was a Youth about 12 years of Age, his head was covered with such foul sores, that I could not stay to view it, without loathing.

A 4th person I met, was a Woman, about 30 years of Age, who was likewise permitted to beg; she said, her disease consisted in the skins scaling from her head, which extreemly itched, and when scratched, did very much pain her, and also bled, and caused those red scabs. She offer'd to uncover her head, but I was satisfied without it; the more for being from home, and lodging at a Friends house.

Of the Scales of Eels.

Among the Fishes, which are generated in our Rivers, and waters, I know but of two sorts, that are said to have no Scales; the one sort is the Eele and *Paclink*, in some places not distinguished, but with us they are distinguished: the *Paling* being flatter and pleasinger in taste, and therefore sold dearer: the 2d sort, is the *Eelpout*; this last sort are short, and thick, and scarce to be met with;
which

which two sorts of Fish, the Jewes will not eat, as forbidden by the Law of Moses Deutr. 10, 14, &c.

I examined the skins of these Fishes, after I had cleared them of their slime; and found them covered with Scales, as much as other River Fish; for the Scales, altho' very thin, and small, lay orderly, and close fastned one over the other. Besides these Fishes are also provided with Fins, like other Fish; for they have on each side of the head, a perfect Fin; the whole hinder part, or Taile, is as well above as under, furnished with a continued Fin. And for as much as this may seem strange to some, and cheifly to the Jewes; who for want of a more neer search, into the constitution of this Fish, have been diverted from so relishing a food: I caused one of those Scales, which I had taken from under the Belly, where they are the least, to be drawn out, as viewed by a Microscope: but while the Artist was imployed in the doing thereof, he said, he could as soon cut it in a Plate, as draw it, and I therefore caused him so to doe: of which you have here the Print Fig. 8. *ABCD*. is the Scale taken from the Belly of a great Eele, the Circumference of whose head, was neer 7 Inches; but the Scales on the back, and sides are larger; the greatest part of this Scale *ADC*. was covered by two other Scales: the part *B*, lay extended towards the Tail: the rest lay after the same manner. These Scales are for the most part, constituted of round Balls, and some oblong, in which Balls, in many places, appear figures, like a spiders webb; which for the extream finess and smallness, could not be imitated: the Globules constituting each Scale; are very transparent, but some more then others: and in each Globule, appeared a darkish spot; those less transparent Globules, lay one by the other, and made different Circular lines in the Scales: altho' all the Scales, are not just of the same shape, I have yet observed, in many of them, as I judged, the same number of Circular lines. From
whence

whence I conclude, that every year, the Scale encreased one Circular line; and by consequence, the number of these Circular lines, being seven; the Fish must have been seven years old. These Circular lines are here denoted Fig. 8. by *EFGHIKL*. Fig. 9. is the same Scale in size, as it appears to our naked Eye.

I have also examined, the slime lodged on these Scales, but I can say little thereof, till I have made further Observations. &c.

Delft July 25th, 1684.

*The Chymical Touch-Stone of Mr John Kuncle,
Gentleman of the Bed-Chamber to the Elector of
Brandenburg, De Acido, & Urinofa Sale Calido
& Frigido, contra Doctor: Voights spirit: Vini
vindictum.*

*Submitted to the Royal Society of London &c, as to
the high Judges of this matter.*

Berlin the 6th. of July 1684.

THis book, having been sent the *R. S.* by the favor of that most Potent Prince, and great encourager of Learning, the *Electo*r of *Brandenburg*, may for that reason, deserve a large account to be given of it, as also for the merit of the persons therein concerned, who dispute, like Philosophers, with Experiments in their hands; partly also because the book is written in High Dutch, a language which few of us understand sufficiently.

The Author begins with an Epistle Dedicatory to the *Royal Society*; appealing to them, as to impartial judges: he says, that in his book, he offers at the nature of heat, and cold; in which, or any other thing, in case he has committed errors, he shall be made very happy, to receive better Instructions.

In the next place, he maketh an Epistle to the Reader, which is only an Apology, against some calumnies thrown upon him.

After this, follows a short Epistle of Mr. *Kunkels* Antagonist Dr. *Voight* to Dr. *Martin Weisen*, which is a short address made to him, as judge of the controversy.

Mr. *Kunkel* begins to lay down, his Opponents Propositions; which are three.

1. That there is no *Acid* under the Sun, that of it self gives

gives either heat or flame: for he says, that there is no *Acid*, of either the Vegetable, mineral, or Animal Kingdom, which affords it. He instances in the *Acidum Ventriculi*, & *fucci Pancreatici*, whereas on the contrary, the Gall, which contains no *Acid*, but affords Oyl, gives also flame, and heat.

2. He endeavours to prove spirit of Wine, to be an Oyl.

3. He obviates some Objections.

Mr. *Kunkel* in answer to the first Proposition; says, he never declared it his opinion, that any body should produce heat, without the Accession of a *Frigidum*: (which in other places he calls *Urinosum*,) as also, that spirit of Wine was a pure *Acid*; but a *spiritus duplicatus*: but that there is more *Acid* in it, then of the *frigidum*, he is sure, cannot be denied.

He agrees with his Opponent, that no pure *Acidum* is inflammable, but that *Urinosum* and *terra* must be added. He denies that there is a pure *Acidum* in the World: for he says, where there is such a pure *Acidum*, there must be a pure salt; but there is no such thing in the Animal, or Vegetable World.

He examines 18 Ounces of the Gall of an Ox, from which he obtains 16 Ounces of cleer water by Distillation, of a stinking Oyl, and half an ounce of a salt Earth, in which he says there is a *Sal Acidum*: so that he would ascribe Inflammability to belong rather to the *Acidum* then *Oleosum*. He examines blood also, from whence his Antagonist may argue, namely that the Oyl in the blood, gives the naturall heat to the body; but he will ascribe more to the salt: for he says, that in case blood be gently evaporated *ad siccitatem*, and then exposed to the Air, a certain salt, of a Nitrous Nature, will grow upon it: by this you may see the salt to predominate, in case you edulcorate this dried blood by frequent ablutions with water, and then distill the mentioned exsiccat-

ed Mafs, you fhall have much lefs Oyl: from whence we may learn, that Oyls are the moft fubtile parts of bodies; and may alfo conclude, that nothing is to be found without falt; or that bodies are fet together, and compounded with falt. He feems to deny, that *Salia Acida* (fuch as his Antagonift calls *Succus Citri*, *Berberum*, *spiritus Nitri*,) are cooling, or do fo well perform any Cures, as *Salia Urinofa*. He examines the *uccus citri*, and *Berberis*, by diftillation, the latter of which, he fays, affords only a quantity of water, fome oyl, and fome earth, mixed with a falt he calls Alkali; which makes him demand, what is become of his *Acidum*.

Mr. Kunkel proceeds, and gives a further account of Dr. Voights oppofite fentence; who instances in his common diftillation of Wine, namely, that after the Spirit of Wine *Per Balneum Mariæ* is feparated from the Wine, that which remains in the Veffel, becomes fower, and will not burn, tho' perhaps fomewhat of a fubjugated oyl, may be mix'd with it: but in cafe you feparate any oyl from the *Acid*, it then burns *per fe*.

Mr. Kunkel in the beginning of his anfwer, feems to run out againft the Doctors opinion, mentioned in another chapter; and endeavouring to prove *spiritus Vini* to be no oyl; becaufe oyl will not intoxicate a man; and becaufe *Acids*, tho' of differing families, do all unite and mix, and fo do oyls too, but if you mix that oyl drawn from Wine, with the Spirit of Wine, it will not by fhaking unite together, unlefs you firft fatisfy the Spirit with its falt, and by that means you may caufe a union of fome little quantity. He now comes to overthrow the Doctors affertion, that *Acids* do not burn: he instances in oyl of Vitriol, as one of the pureft *Acids*, which produces great heat, which deftroys and fhatters many things. Judge of the contrary by the greateft cold. Take fpirit of Wine highly rectified, pour the coldeft water upon as much, as you can hold in your hand, and it will
grow

grow pretty warm. Whence it undoubtedly follows, that it agrees with oyl of Vitriol in point of *Acidum*.

He concludes, charging his adversary that he says, Vegetables yield no *Acidum*; but gives an experiment to prove the contrary. *viz.* that the *Sal Alkali*, and *Sal Urinosum* of Plants, by a well proportioned quantity, may be brought to a *Sal Nitrum*. Item *ex sale Tartari*, or *Absinthii* by a meer addition of sand, a *Spiritus Salis* may be distilled.

Dr. Voight Mr. Kunkels opponent, proceeds to the *Regnum Minerale* and absolutely denys any heat, flame, or light, to be properly inherent in any *Acid*, but that some central oyls not easily separated from mineral *Acids*, do produce those incalcescent effects. He instances in *Oleum Vitrioli*, & *Tartari per Deliquium*: as also in *Spiritus Nitri & Vitrioli*, which derive much heat by mixture, from a latent oyl, and not from the apparent external *Acidum*. He gives an experiment, how, *Oleum Sulphuris* may be made inflammable, *viz.* by distilling a high tincture of *Oleum Terebinthinæ* made with common brimstone, for you may by distillation recover your *Oleum Terebinthinæ*, and leave in the bottom of the Retort, an inflammable oyl of Sulphur.

Rain water, he says, affords oyl, and volatile salt, but no inflammable *Acid*.

He says all *Acida* tho' never so pure, if evaporated or distilled off, will always leave in the bottom of the Retort, or other Vessel a *Materia pinguis & unctuosæ*, out of which an inflammable oyl may be brought.

He concludes saying, that it suffices to prove, that *Acidity* does in no wise dispose a body to inflammability, because *Olea expressa & distillata* do burn and flame more readily, when they are purged of all mixture of *Acidity*: as *Oleum Lini*, *Terebinthinæ*, *Anisi*, *Feniculi*, when distilled *per Cineres*, and other *Alcalia* that detain the *Acida*.

Mr. Kunkel in his answer denys, that in these Mineral

ral *Acids*, particularly oyl of Vitriol, any oyl is contained ; he challenges him to give Demonstration.

He demands further, since he declares all heat to depend on bodies, upon the score of their being oily, that he will shew him an experiment, how to produce heat, with the mixture of any oyl and water ; as Mr. *Kunkel* has often done with *Acids* and water.

Mr. *Kunkel* refutes at large, his experiment about the oyl of Sulphur ; urging, that he did not perform his operation truly, but left his oyl of Turpentine at the bottom of the Retort, which is mistaken for the oyl of Sulphur, as he may easily discover by drawing off more of the remaining oyl, by which means, he leaves a kind of black Earth, and such as gives no oyl, and may have his former weight of Sulphur again.

The adversary Dr. *Voight*, proceeds to lay down several Positions.

1. That oyl of Vitriol is the most fixt *Acid*, and gives more heat, then spirit of Wine whilst flaming.

2. That fixt bodies are only respectively so.

3. That *Acids*, may by repeated distillations, be brought to such a degree of subtlety (*I suppose he means volatility,*) as spirit of Wine.

4. Any surmise about an *Acidum Occultum* signifies nothing, for even that may be easily parted.

5. All *Acida* are volatile, because they yield a strong scent, which comes from their Volatile salt.

Now since we can find no inflammable *Acid* in the World, we may properly infer, spirit of Wine to be no *Acid*, because it burns, and takes fire. He concludes with a definition of *Acidum*. *Quod Acidum sit Sal fluore potitum, Vim habens astringendi & coagulandi.*

Mr. *Kunkel* in his answer grants the first Position. To the second he gives a check, blaming his not distinguishing betwixt the *Acida Regni Mineralis & Vegetabilis*. The next Position he denies absolutely. The fourth Position he

he answers thus, that any *Acidum* may be concentrated in a body, and is there stronger, or have its parts extended and diffused, and so weaker; so that *magis & minus* do much vary the case. To the last, which says all *Acida* are *Volatilia*, because of an odor or sent that rises from them: he denys that all do give an odor, and instances in *Oleum Vitrioli*, that gives none; and by consequence no *Acida pura* afford it, but such as are mixt with an *Urinosæ salt*. He pretends to know a method how to reduce spirit of Wine, to water, by separating its salt, with the help of salt of Tartar. As also to part the salt from oyl of Vitriol, and bring it to water: but none of these salts are reducible to oyl, tho' they may be made to heat and burn. In the end he seems to dislike his definition of an *Acidum*: because he says he does not distinguish betwixt *Acida pura & mixta*, such as *succus Berberum & Oleum Vitrioli*.

Dr. Voight goes on to prove from his definition of salt, that spirit of Wine is no *Acidum*, namely because it has no *Vim attenuandi & resolvendi*; he means properly and in its own nature, which consists in its inflammability, so that *Spiritus Vini*, when it acts the part of a *Menstruum* to dissolve bodies, does it upon the account of some *Salia Volatilia*, that are mixt with it: for the more you impregnate it with salt, the stronger *Menstruum* you shall have. Item if you separate the inherent salt in oyl of Turpentine, you will destroy its power of working upon *Rosins*, so as to dissolve them. Hence he infers, *Non dantur Menstrua Sulphurea Oleosa*.

2. He says *Spiritus Vini* is so far from agreeing with his definition of *Acids*, in having *Vim coagulandi*, that it rather hinders it. e. g. *Acids* coagulate Milk: spirit of Wine keeps it in a body together, and hinders that Coagulation.

3. Spirit of Wine corrects *Acida*, by dulcifying spirit of salt and Nitre, when mixed with them; which are great Corroders of themselves.

4. Spirit

4. Spirit of Wine keeps bodies from degenerating into *Acids*, thus it preserves Beer from fowring. Item it hinders the fermentation of *Vinum Mustum*, and the working of Beers.

5. *Acida* give a red tincture to syrup of Violets, spirit of Wine dos not change it.

Thus far Dr. Voight. To the first proposition Mr. Kunkel replys, that since *Spiritus Vini*, according to his Concession, abounds with salt, and is upon that score a *Menstruum*, and can be sooner reduced to salt then oyl, that for his own reasons, it may better derive its properties from salt, then from his imaginary oyl. He gives us an experiment *viz.* That *Spiritus Vini* dissolves the Crytals of Silver which it could not do, he says, unless it consisted of an *Acidum & Urinosum*; for no *Oleosa* whatsoever, must pretend to this effect. He challenges him to separate the salt from the oyl of Turpentine, which he thinks cannot be done; unless you destroy the nature of the oyl.

To his second proposition, that *Spiritus Vini* hinders coagulation, and to his Instance in common Milk, he says the contrary; *viz.* That spirit of Wine and Milk in equall proportions, will coagulate as Vinegar and Milk doe.

To the 3d, which is only an instance, that spirit of Wine dulcifies *Acids*, he denyes it to be *dulcis*, but yet very corrosive, and that it is diluted only as water will yet more effectually take off the pungency of the *Acid*.

To the 4th, where spirit of Wine preserves bodies from turning to Vinegar, and stum liquors, Mr. Kunkel, lays, that this is a plain proof of its being an *Acidum*; for the sower vapour of accended Brimstone produces the same effect: only with this difference, that the like *Acidum* in spirit of Wine is less copious, and for that reason you must use a much greater proportion of spirit. So that
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the induction is false, that there is no *Acid* in spirit of Wine, since *Acids* do generally, if not always hinder the fermenting of bodies.

To the 5th, he answers, that spirit of Wine digested with Syrup of Violets, will change the colour.

Dr. *Voight* having thus far been upon the Negative, by declaring what spirit of Wine is not, ; he now asserts it to be an oyl, which is ardent or inflammable, by no means upon the score of its Volatile salt, for then salt of urine must burn ; nor upon the account of any *Acid*, which has been already refuted ; much less upon the account of its water and Earth, for that were absurd : *ergo ratione Olei*. He gives an Instance how spirit of Wine may be reduced to a true oyl, for as it is a spirit, he says it has only lost the outward form and consistence of oyl, being made more fine and subtle, yet notwithstanding, he proposes a way to bring it to oyl again. Take a quantity of high spirit of Wine, put it into a Cucurbit, which is not very well closed, let it stand for 3 months, then endeavour to rectify it in a gentle *Balneo*, you will find little spirit that will rise, but a good quantity of inflammable oyl will remain at the bottom.

Mr. *Kunkels* answer does principally consist in denying the experiment, of reducing spirit of Wine to oyl, by the way and method proposed, or by any other : unless he perhaps first united some oyl with his spirit, and then the Air having sublimed the spirit, which was lighter than the oyl or water, by this means perhaps, he obtained some little oyl.

Dr. *Voight* examines an Epistle of Mr. *Kunkels*, sent to him for that purpose.

The first Præsupposition of the Author of the Epistle is, that all Vegetables contain an *Acidum & Urinosum*. The 2d. that all Fermentations produce *Acids*, which are separable by Art.

In answer to the first, Dr. *Voight* complains of his
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having omitted *Oleum*, which is more certain, and constant in all Vegetables, then *Acidum*. For pepper, Ginger, Camphire, Nutmeg, &c. have no *Acidum*. Thus we see oyl in abundance in *Seminibus Lini, Citri, &c.* and Flax affords this oyl before and after many Variations, into cloath, Paper, &c. which upon burning gives volatile salts and oyls, but no *Acids*.

Mr. *Kunkel* will not allow his instances in Pepper, &c. to be just, but on the contrary, that they contain a *Sal Volatile & fixum*, or an Alkali salt; In like manner does flax, and Paper, consist of much the same principles.

Dr. *Voight* goes to the second supposition, of the Author of the Letter, that all Fermentations produce *Acids*, which are separable by distillation. This he refutes, as contrary to experience, since mead, and Canary Wines, and even their Berlin Beer it self, will ferment very high, without any Acidity; but rather continue very pleasant, and sweet. He owns that there are Wines, both French, & Rhenish, that after fermentation, do tast a little sourish or sharp, but that he says, follows fermentation *ex accidenti ratione materie*, for these Wines contain before fermentation, *Partes salinas* in that quantity, that they exceed the *Oleosas*. and so by fermentation, are brought into a *fluor*, or state of Acidity. In Spanish or sweet Wines, if you suffer their salts, by a considerable addition of water, or otherwise, to break the *Vinculum Unionis*, so that they are brought to be sower, this is not properly a *Vinum Fermentatum*, but *corruptum*. However, tho' this were true in Wine, it will not make it good in spirit of Wine.

Mr. *Kunkel* replies here, that he has not fairly prosecuted the work of Fermentation, which if he had done, out of all Vegetables, an *Acid* might be made.

In reference to other Wines, he confesses, they have a sower Ingredient in them, which he can easier produce, then a true oyl.

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He dislikes his too subtle distinction into *Vinum corruptum* & *Fermentatum*, both being slower, and effects of fermentation, may properly be called *Acetum* or Vinegar.

Dr. Voight proceeds; in the Epistle, he animadverts upon Mr. Kunkels Notion, *viz.* That salts by Virtue of their *Acidity*, do preserve bodys from corruption. This he says, is against reason and experience: for salts are endowed with a power *Solvendi, incidendi, corrodendi, dis-uniendi dividendi*: the most corrosive Menstruums, as *Aqua fortis, Regis, &c.* do justify it. As also the constitution of Vegetables, and Animals, both which do soon corrupt and dissolve, upon the account of their abounding with this saline principle. Nay salt it self, cannot resist the moisture of the Air, being soon resolved in it. He instances yet farther, in the common way of powdering or pickling flesh, declaring against the ill quality of salt, for depriving flesh of its proper and genuine taste, bringing it to an *Acorem*, and corrupting instead of conserving it; by making it unfit for nourishment, in producing diseases, &c. After this manner does Vinegar, instead of conserving a body, deprive it of its good Juice and relish: on the contrary he knows, how to make a Balsam of sugar, which is an oily body, that will easily preserve bodys; and 'tis well known, that oyls of Turpentine, of Myrrh, and Spirit of Wine, do best conserve *Cadavera*. Moreover, he's so far from allowing this effect to his *Acidum*, that he will much rather yield it to his *Urinofum*.

Mr. Kunkel in his reply, refers himself to the good housewifery, and common custome, and universal experience, which justifies his salt, tho' an *Acid*, to be a true preserver of bodys from corruption: he then dislikes his conceit, that flesh abounding with salt, should therefore corrupt; but on the contrary, being sweet, and wanting salt, does therefore the sooner putrify. This he proves

by an instance, that a whole Ox has very little salt in it (I suppose he means of fixt salt,) he thinks a Pickled herring, or powderd beef, very unjustly termed corrupted Fish and Flesh. He wonders at his choice in preferring *Salia Urinosa*, for the preservation of bodys, before his *Acida*; these destroying the tast, and scent of bodys.

Dr. *Voight* takes up the Author of the Epistle, for urging an experiment, which he calls, against reason and experience: namely that a pound of rotten Wood, contains more *Acidum* or Alkali, then five pound of green Wood: he pronounces the quite contrary for truth, proceeding from one degree of Putrefaction, to what he calls a Central Corruption, or rottenness of Wood, where he found, that Wood no ways tainted, afforded the most salt, and that in every degree of greater putrefaction, or the more the Wood inclined to rottenness, the less salt it afforded, untill he came to that, which was quite rotten, this afforded none at all.

Mr. *Kunkel* answers as positively in his own behalf, that he is certain of the contrary, and could make it good.

Dr. *Voight* complains of the Authors Epistle, that he confounds *Salia Alkalia* & *Acida*; for they must needs differ in their natures, which make so great an effervescence in their mixture, as *Sal Tartari*, & *Spiritus Vitrioli* do. He demands an experiment how to make an *Acidum ex Sale Alkali*.

Mr. *Kunkel* answers, that while these salts are in their gross form (as he styles, it) they are very differing: but in a Book he calls his Annotations, he shews a way how to reduce *Alkalia* to *Acida*, & *Vice Versa*: and that only by depriving one of its Terrestricity, and giving it to the other. He instances in *Sal Absinthii*, out of which a spirit may be drawn to dissolve Gold.

He animadverts farther upon the Epistle, where he finds this assertion; [no body can deny, where you have heat and light, you must needs have two contraries, namely

ly heat and cold, or an *Acidum* and a *Urinosum*.] This the animadverſor ſays, is *contra rationem*: for two contraries, *non poſſunt immediate eundem effectum producere*. He ſays *Acidum* & *Urinosum* may perhaps be externall or chance cauſes of heat, by promoting a ſudden motion, and conflict in ſome bodys, but muſt not be confounded with the matter, that is inflammable. Thus water, and oyls of Vitriol mixt together, produce a much greater heat, then if you ſhould put into the oyl of Vitriol, a quantity of Urinous ſalt: but 'tis plain, that in the water there is an *Urinosum*. Thus if you pour water upon *Calx Viva* (which is an Alkali, and has nothing to do with *Acidity*,) you will produce a great heat, yet we want here one of the two Principles of heat, *viz.* the *Acidum*.

Mr. *Kunkel* thinks he has made it clear, that theſe two Principles were demonſtrated very plainly: he to elucidate the matter, gives us ſome effects of *Spiritus Acidi* (as for inſtance *Aquaſortis*,) and *Urinoſi* (as *Spiritus Urinae* it ſelf,) theſe two in conjunction diſſolve Gold, make *Aurum Fulminans*, produce heat, flame, and even lightning. As to the experiment of water, and oyl of Vitriol, he anſwers, that tho' he ſhould ſtill continue to deny, that water holds no *Urinosum*, yet he muſt allow it to be a *frigidum*, which yet afforded this warming effect. As to the experiment of *Calx Viva*, he will not allow it to be without an *Acidum*. He would confirm his opinion, by an Inſtance of the great *Phosphorus*, (called in *England* the ſolid,) which he ſays hath nothing either Oleaginous or Reſinous, but holds *Salia Acida* & *Urinoſa*: and yet performs ſo many Luminous effects.

Dr. *Voight* makes further ſearch into the Letter, and obſerves, that the Author gives the reaſon, why ſpirit of Nitre, and ſpirit of Wine, make ſo great an Ebullition, but ſpirit of Wine, and oyl of Vitriol none at all: *viz.* becauſe Nitre is not ſo pure an *Acid* as Vitriol, for that reaſon, they may ſtand the quieter, and without Altera-

tion together. To this reason the Doctor gives no credit, for he says, spirit of Nitre is as pure as that of Vitriol, and that with spirit of Wine, they doe make an alteration: and the higher they are, the more they heat, but if very highly rectified, they will produce flame upon their mixture.

Mr. *Kunkel* seems to be in no wise of his judgment, that the mentioned *Acid* spirits, are of an equall purity; he thinks, in that of Nitre, there is some thing of an *Urinosum*; in the oyl of Vitriol, none at all. As to the experiment of flame, produced by oyl of Vitriol, and spirit of Wine, he tells him, that he read it out of an Author, but it never succeeded.

Since spirit of Wine is an oily body, the Author of the Letter, makes a question, how it comes to pass, that it makes no ebullition, and gives no colour to any spirit, except that of Nitre? to which Dr. *Voight* answers, because it causes no more ebullitions, for that reason, it approaches the nature of oyls; for *Acidum* & *Urinosum*, does only excite those ebullitions. He answers further, that it does indeed make ebullitions, both with spirit of Nitre, and of salt, but that it does so, by reason of an *Urinous* salt, it contains.

To this Mr. *Kunkel* thinks, he has copiously answered, and therefore supersedes.

In the Epistle, Dr. *Voight* answers, to this objection, that if spirit of Wine were an *Oleosum*, why it would not mix with oyl: he answers it, by proving the contrary, that if you put into high rectified spirit of Wine, oyl of Fennel, or Anniseeds, it will dissolve.

Mr. *Kunkel* replys, that it retains some few drops of this oyl, by reason of that small quantity of *Acidum* in the spirit; but if you impregnate it with more salts, it will take up, and dissolve more oyl. Also that it easily parts with this imbibed oyl again: but true oyls do all equally and thoroughly mix.

The

The Author of the Letter, having put another Query, about the *Causam Ebrietatis*, namely, whether it depended on a body, as Oleaginous, or as sweet, Urinous Alkalifate, answers *propter Acidum*? To which, Dr. Voight demands of him to shew an *Acidum inflammabile* taken out of spirit of Wine. He proceeds then himself, to give an account of drunkenness: that Wine affects the Animal spirits, not as an *Acidum Volatile*, for that does rather fix and coagulate the spirits, then excite them; that the *Salia Coagulata* will not operate, when *Resoluta* they only do perform quick actions; so that *ratione Olei*, rather than *Salis Acidi* Ebriety may be accounted for.

The Author of the Letter, will not allow it to produce drunkenness as an oyl: He quite de vests oyls of that quality, having never heard of any that got fuddled by drinking oyls: but that oyls have been taken into the body, as Preservatives against drunkenness.

Mr. Kunkel concludes with his address to the *R. S.* excusing himself upon this consideration of the great necessity of knowing the true nature of things: particularly of heat and cold: and that without a true account of the nature of salts, the harvest of Chymistry will be very poor. He complains of the great mistakes of Chymists, who for want of a thorough examining the parts of bodys, have mightily deceived themselves, and others: and also of the little agreement amongst the Analizers of bodys, *Chimice*, even in matter of fact. For which reason being resolved to bring things to an exact examen, he says, I began first to work upon salts, and because those of Vegetables were the easiest, I chose them. I observed that since the *Animalia* lived on *Vegetabilia*, that there was an Assimilation in their salts. In like manner I observed a very great affinity in the nature or constitution of Metals, excepting Gold, which required some extraordinary preparation to deal with it. This made me at length conclude,

clude, that there were two differing natures, both in salt and metals. This lead me to the consideration of heat, and cold, of the properties of Light, and of the Sun. But nothing has more taken up my thoughts, and engaged my contemplation, then that of light: of this I may perhaps, some time speak at large. The nature of water I find to be cold; and as there is an Universal cold, so there must be an Universal warmth: by vertue of these two, all things are generated; the Sperm of the Earth it self, is in the water. There is nothing comes neerer the nature of water, then salt, because that is first generated in it, and does easiest dissolve again there. I have also found, that because under ground there is a constant degree of heat, therefore those salts that are there generated, do maintain a greater degree of naturall heat, then such salts have, which had their Original aboue ground. Also because I found a remarkable difference in the separation of salts, and in the solution of Metalls, I sought after the purest salt; which I found to be in Vitriol, or Sulphur, having both the same Minera: but since in this, I found a hot and fiery temper or quality, in some other salt, I expected its contrary. Having often perceived *Salia Volatilia*, & *Urinosa*, to produce degrees of cold, without any Corrosive disposition; it made me search, and enquire after, an Universal *frigidum*, which I found in Water: but moreover, as soon as a Salt was generated there, I perceived it also to be warm, or of a mixt Nature, holding both heat and Cold together. In so much, that I could find no pure Salt, of one simple nature: But discerned, by reason of an ascending heat, and a descending cold, we had always a *Præcipitat*, which was for the most part, a salt, or the *Materia Salis*, which first of all seemed to become a very subtile Earth, which in time, as it hapned to be situated, became a more gross and conspicuous salt. If this water happen to fall upon a sandy ground, it cannot sink and rest there, but by a
constant

constant Circulation, is driven and born upwards, wherefore such places prove barren. On the other hand, those places which do embrace water like a sponge, as the marsh lands do, these grow warm, and make almost an inseparable union, with the salt contained in the water, which makes that land very fruitfull. So that I cannot but believe, that there must be two contrary salts in *Regno Vegetabili & Animali*, that contraries are necessarily found in bodys soluble, and combustible, which overthrows the Maxim : *Contraria in uno Corpore non*, &c. Again, in some measure tis true, *contraria inter se pugnare*, when by Motion, they are brought to a disproportion : but, when by nature, or Art, they are brought to contain true proportions, this proverb hath an end. Thus heat and cold, when one much prevails over the other, produce Thunder, and Lightning. But of this notion, I hope another time, to give a farther explication. I shall only speak a word, to the opinion of those, that think Thunder, & Lightning, proceeds from Sulphur, because they have found it to rain Brimstone ; which is nothing else, but the yellow dust, to be found in the blossoms of the Fir Tree, and of the Pine Tree, and also of the Hazel, blown off, and carryed by the Winds into the Air, which is again thrown down upon the ground, by Violent storms of rain : upon the examination of this powder, they may soon find it no Brimstone. Others are carryed into this error, that heat, and flame, must needs proceed from oyl : but we must leave them in their meaning, because these imagine, they have hit upon some new thing. All new matters, if they have but a foundation of truth, are good, or bad, as they are made use of.

That I may not in an affair, wherein perhaps, you have made much better Observations, too long detain you, I shall only select an Observation, or two, wherein I have particularly observed, that a *Calidum & Frigidum*, are to be found in a Fulminating, and combustible body. I shall also be glad to be informed of the contrary by any

Chymist in Europe, if he can find out any body, that by a fair Chymical examen, does not contain *Calidum* & *frigidum*, except the true oyl of Vitriol, which (as we have already said,) has only so much *frigidum*, as it contains *Humidum* or common water, which is so far overballanced by the *Acidum*, that we can discern no *Frigidum* at all. In this Menstruum all metals can be dissolved, excepting gold, which requires a *frigidum*, to be joined with a *Calidum*.

These terms of *Acidum*, *Urinosum*, and Alkali, have so much confounded all men, that it has moved me, to write particularly, and copiously of them, in *Laboratorio meo Experimentalis*. But in short, I find all *Acida*, excepting *Oleum Vitrioli*, to consist of *Salia composita*, mixt with a *Sal Frigidum*. Alkali salts, are all much the same, if clean and pure, and nothing else but *Salia Acida cum frigidis*, and are much a kin to common sea salt, when that is dispirited.

The *Acids*, if you fix them by a mixture of Earth, become Alkali salts. But in case you joyn pure oyl of Vitriol with such an Earth, as *Cornu Cervi calcinatum*, which carry's in it no more of an *Acidum*, or of an *Urinosum*, this will not yet agree with other Alkalys, unless you give it a supply of an *Urinosum*.

Salia frigida if pure, are all homogeneous, let them be made of what Vegetables, or Animals soever: from whence I infer, that nature only makes use of these two principal parts: which since I came to understand it, has excused me from many a troublesome work or operation, and would also much lessen the processes of many, and lighten their labours, did they but know the true property of those bodys they work upon.

Since now I suppose my self, to have laid this firm Foundation, I will only hint at two or three well known materials, out of which heat, and Lightning may be brought, in which no *Oleum* can be demonstrated to have been contained. This I needed not to have done, because, you have made more Experiments your selves of this nature: I only do it with regard to the *Oleisti*, who
would

would fain introduce some new thing, even against experience, & who would yet farther confound, the confused World, through their opiniated Philosophical Arguments, whereas they had more need be lead out of mistakes. I shall begin with *Aurum Fulminans*; to prepare this, is so well known, that I need not describe the way. The Gold cannot be dissolved without a *frigidum*, but when it is once dissolved by it, it must be precipitated by the same again, e. g. with spirit of Urine; by this means, you get a powder, that gives a great report, a very clear light, and burns. If you cannot see the Lightning, for it is very transient, you may put out the Candle, and you will easily discern it. Here is nothing but an *Acidum* and *Urinosum* joined by an Earth; from whence this Thundring noise proceeds, of which in some Manuscripts, that I have yet by me, I have more copiously treated. Perhaps it may be said, that if I precipitated the matter, with salt of Tartar, it would be one and the same thing: why dos this make it heat as well, as if it were precipitated with an *Urinosum* or *frigidum*. I answer in few words: that there is already in the solution, as much of the *Urinosum* as is necessary, so that a farther affusion of an *Urinosum*, will not well agree. Therefore it happens, that when the Gold is precipitated by this Alkali, so calld, the *Urinosum* may be so suppressed, as not to make an explosion (the reason of which is also well known to me,) now in case the precipitate should be dried, and imbibed sometimes with a spirit of urine, it will then recover its fulminating power again. So that we see, where heat and flame is, there must be two contrary Principles.

In the next place, If I take a good spirit of Nitre, and drop upon it *guttatim*, spirit of Wine, until it ceases to make an ebullition, the *Urinosum* is then in a ballance with the *Acidum*. Only put this salt in a heated crucible, and it will go off with an explosion; only you have here no report, but heat and light: but if you joyn it with an Earth (as *Aurum Fulminans* is,) you shall then have a re-

you. This spirit of Nitre, and calcin'd coral will doe, if they are imbibed, or brought to be dry. Iftwere necessary, I could instance in that burning mixture *ex Oleo Vitrioli, spiritu urinae, & Jove*. in all these we have a *Caldum* & *frigidum*, which is brought into motion by warmth, and may give you heat, Thunder, and Lightning as you please to manage it. Salt of Tartar, Sulphur, and Nitre, make a fulminating powder, he will err here, that will ascribe the effect to Sulphur, as if it produced it, by vertue of its oyl, it is very plain, that it proceeds from the two contrary salts. The *Acidum* alone produces heat, but no flame, unless the *frigidum* be added. Just as a red hot Iron, may burn, or scorch a thing, that it cannot bring to flame, unless the *frigidum* should meet it. Oyl of Vitriol burns wood, which it could not do, unless it met its contrary there. I will pass by the terrible heat, excited in the solution of *Jupiter* & *Mars*, altho' many such might be appealed to, which are well known to the experienced. I shall only mention the wood coal; take it & let it be thoroughly kindled, and then go out of it self: kindle it thoroughly once more, and let it quench, or go out in a crucible or some place where the cold Air, may not too much annoy it: this may be done ten, or twenty times successively, and it will continue to give heat, and light: if this came from oyl, sure it must needs be a very fixt oyl, and tis impossible it shoud perform such a work: but a *Sal duplicatum*, which by vertue of its terrestreity, is call'd an Alkali, is to be found here.

But least I detain you too long, I shall conclude with my desires, you will not ill resent this my Address, but at your leisure hours, set down your determination in a Page, whether I have treated things contrary to truth and experience, whatever it be, I shall willingly embrace it, and be glad to be better informed, &c.

F I N I S.

Printed at the Theatre in Oxford, for Hen. Clements
Book seller in Oxford.

PHILOSOPHICAL

TRANSACTIONS.

March 23^d. 1685.

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A Remar-

A remarkable account of an Hydrophobia, in a Letter from Dr Roger Howman, Physician in Norwich, to William Briggs M. D. Fellow of the Coll. of Phys. Lond. and Physician of St. Tho. Hospitall.

Sir.

I Had long since (if business had not prevented me,) returnd you thanks for the *Philosophicall Collections* you sent me; and therein, particularly, for your *new Theory of Vision*, so highly rational & satisfactory. Among your many other exact and curious observations, I can't pass by that remarkable relation of the *Hydrophobia* (given by the learned and ingenious *Dr Lister*,) without applauding the curiosity of the observer, in his most exact historie of that disease; and having lately had an opportunity of making some remarks upon a case not much differing (tho' the occasion is more rare,) the *biting of a mad Fox*; I thought my self obliged to satisfy your curiosity therewith (if worth reading,) as followeth.

On Wednesday at evening the 1. of Octob. last past I was called to a patient in this City, who about 6 weeks before had been *bitten with a mad Fox* on the right hand; he began to be indisposed the Saturday before with running pains, yet so well as to be abroad next day at Church: on Munday his pains grew more troublesome, and the day following, much worse, especially, on his right hand, arm, shoulder and back, but not to confinement: on Wednesday (I know not by whose advice,) he took a dose of the common purging spirit of Scurvy-grass, which gave him 7 or 8 stools, and made him very faint, and weak; so I found him; and complaining that
he

he could not use his right hand (it beginning to be paralytical,) tho' his pains were much abated there, and where else they had been most troublesome; only on the lower parts, or small of his back, which soon after vanished also. He told me he bled freely at the wounds the *Fox* had made, and that they healed without any farther trouble, than now and then a little girding pain on that hand & arm; and further said, (to please his friends,) he had taken a *white Powder* of an Apothecarie, and believed himself in no danger of what was feared (for I had discovered the danger I apprehended in his condition:) tho' the *Aquæ Pavor* did not yet appear, his heat was much encreased and his Pulse intermitted every 5th or 6th stroke, but *on the right side only*; which I again and again examin'd, finding no variation: he also looked gastly & thin, but his Eyes sparkling and fiery. I prescribed the best temperate *Antispasmodic* and *Antiparalytic Remedies* I knew, to be mixt with the specifics of common use in a *Hydrophobia*; thus much on Wednesday at Night. Next morning he complained his Night had been restless, that then he had wholly lost the use of his right hand, and tho' the pains were more abated, yet he was very hot, and uneasy: his Pulse then was much stronger, then over Night, but intermitted on the right side only as before, his countenance was somewhat more gastly, yet his Veins very full as in *initio & augmento febris*, and no *Hydrophobia* appearing; I advis'd him to bleed 6 or 7 ounces at the left arm, (the right being paralytical,) and the continuance of what I had prescribed before; he bled 8 ounces very freely, the blood well coloured but very thick. This on Thursday morning: in the after noon going into the Country to visit some patients, to whom I was preingaged there, I could make no further observations till my return on Friday 6 at Night; not many hours before he died. On Thursday after I left him, the great Symptome appeared, and in my absence, another was consulted

who gave him many remedies. At my return his heat was very great, and his Pulse very high, and intermitted then on both wrest's, and if any thing were offered him to drink standing or sitting, he started as if his head would have fallen backwards off his shoulders, but when lay'd upon his pillow, could (tho' with great difficultie & uneasiness,) now and then get down a spoonfull: he looked then very thin and gaitly, and seemed shy or afraid of every body that came suddainly near him, telling them *they Stifled him*, or stopt or hindred his breath in coming so hastily to him. His reason was all a long very good, and (as some observed,) better than in his health: his voice was broken and imperfect, as theirs whose tongue and other organs of speech are growing paralytical, thus at 6 a clock Fryday at Night. I saw him again at 10 that Night when all Symptom's were growing worse; yet he could then walk out of one Chamber into another, with very little help, but between 12 and 1 next morning he died, without any convulsive motions, sighs or groans; as if in a moment, there had been a totall *paralysis*. Thus as briefly and as plainly as I could, you have the relation; from whence it's most observable, 1. that as the pains, (which were like those in a Rheumatism,) abated, the *paralysis* and feaver increased. 2dly. As the feaver increased, the intermission of the Pulse grew more frequent, tho' the Pulse were much stronger; but why it intermitted first on *but one side*, is not easily accounted for. 3. That the imperfection of Voice, as well as the difficultie of swallowing were the effects of the *paralysis*, may probably be allowed, & be a satisfactory reason why the Person Dr. Lister mention's, could not use the *Quill* which was given him to suck with. 4. That his thin gaitly aspect, the defect of spirits and *tonic vigour* (if I may so call it, was from a paralytical Original, is not unreasonable to conjecture. 5. That the *paralysis* chiefly affected the muscles of the head and upper parts, may be partly collected from

from his inability to hold his head steady at the approach of any liquor; the fear thence rising, causing him to start, and his head so to *fall backwards*, as if it would fall off his shoulders. 6. And that his lower parts were lesse affected, is probable; because, 2 or 3 hours before he died, he could walk out of one Chamber into another, even when his voice was hardly intilligible. Some Queries offer themselves from what's written, it being a subject never yet well considered of: but I have not time now to name them, nor to be longer troublesome then to tell you I am.

Norwich

Sir Your humble Servant

Jan. 27. 1684.

Roger Howman.

*An extract of a Letter from Senior Ciampini, to
Dr. Croon, concerning a late Comet seen at Rome.*

Novus *Cometes* nuper cœlo visus est à lynceo oculo
Abb. *Blanchini* discipuli Cl. *Geminiani Montanarii*. *Cometes* parvus quidem sed in sua orbita regularis apparuit, lumine tenui, & tanquam stella subobscura, at tubo optico exceptus luminosior. Observationes habes hic junctas & habitas domi optimi Prælati *Vettori*, viri sapientiæ & doctrinarum amantissimi, ut & illis omnisfarium refertissimi.

1684, die 30, Junii St. n. *Cometa* primum mihi visus est, in grad. 9 cum aliquibus minutis Libræ, Latitudo ejusdem Borealis fuit graduum octo & aliquot Minutorum, quæ nondum satis certo determinare potui ex Observationibus, Gradus tamen tam Longitudinis quam Latitudinis extra Aleam Dubitationis est.

Julii die Cometæ Longitudo, Latitudo Bor.

1	11. 18 $\frac{1}{2}$	13. 12
2	13. 16	17. 57
3	14. 58	22. 12
4	16. 45	25. 40
5	18. 30	28. 50
6	19. 50	31. 34
7	21. 07	33. 54
8	22. 20	36. 06
9	23. 32	38. 00
10	24. 42	39. 40
11	25. 44	40. 49
12	26. 38	41. 58
13	27. 23	43. 05
14	28. 32	44. 09
15	29. 49	45. 12
16	00. 58	46. 20
17	02. 08 Scorpii.	46. 40

Quatuor

Quatuor ultimæ meliori Indigent Calculo, nam aliquis fortasse minorum Error Irrepfit; alias etiam nonnullas habeo diei 18 & 19, quæ cum nudo Oculo habitæ sint, abluderent fortasse pluribus minutis si eas nunc afferrem. Postremis hisce Noctibus, cum jam fenscescente Luna stellarum etiam minorum fulgor se prodèret, *Cometam* quoque languentem prospexi prope Lemniscos coronæ: eas proferam cum omnes in ordinem ut par est suum Redegero.

Observatio diei primi Julii accuratissima est, *Cometa* enim in Telescopio apparuit una cum Stella Virginis quæ *Bayero* inscribitur α & accidit sub Cingulo septentrionalis partis primæ.

Observationes sequentes usque ad diem quintam satis certæ haberi possint; omnium tamen Certissima est Observatio diei sextæ, qua die Arcturus in tubo optico simul cum *Cometa* conspiciebatur. Die pariter 14, *Cometa* & stella $\times$ in *Colorrobo* Bootis ceu Venabulo subter humerum uno intuitu detegebantur. Aliæ Observationes etiam satis accuratæ sunt,

Some Observations on Boyling Fountains, and Subterraneous Steams: by Dr. Tancred Robinson, Fellow of the R. S.

Walking out one day from *Montpelier* in company of my ingenious, and worthy freinds Dr. *Sloan*, and Dr. *Wakely*, in order to visit the famous boyling fountain near *Peroul*, a small Village lying east about a league from thence, not far from the *Etang*, I found the water to heave, and boyle up very furiously in small bubbles; as the learned Mr. *Ray* relates in his travells p. 459, and it was very manifest, that this *Phænomenon* proceeded from a Vapour breaking out of the Earth, and rushing through the water, so as to tosse it up with noise, and in many bubbles; for upon digging any where near the ditch, and pouring other water upon the dry place newly dug, I observ'd in it immediatly the same boyling; which the afore mentioned exquisite naturalist does likewise remark in his travells. The like bubbling of water is also found round about *Peroul*, upon the Sea shore; and in the *Etang* it self: in order to search out more narrowly the cause of this odd *Phænomenon*, I took some of the sand and Earth out of the fountain, and ditch, putting it into Vessels, and pouring the same water upon it, but there did not appear the least perturbation, or alteration thereupon; the superficies of the water continuing very smooth, equal, and quiet: yet still, for further satisfaction, I sought out, and discover'd in severall dry places of the ground thereabouts, many little Venti-ducts, passages, or clefts, where the steam issued forth; at the mouths of these channells or pipes, placing some light bodys, as feathers, small thin pieces of straws, leaves, &c. I found them soon remov'd away; this va-
pour

pour upon the application of a lighted candle, or torch did not flame, or catch the least fire; as the fumes running through a boyling spring near *Wigan* in *Lancashire* do; for Mr. *Sherley* made them burn, and flame very vigorously at the contact of a lighted candle; *Philosoph. Transact.* N. 26, p. 483. so that here we have two different sorts of steams causing these boylings, yet neither of the fountains are Medicinal, or so much was arm; the like is related by *Varenius*, [*primo lapide à Culma* (says he,) *fons magno spiritu emittit aquam quasi ferventem, cum tamen sit frigidissima, unde vocant Insanam.*] The learned Dr. *Plott*, in his late book *De Origine Fontium*, mentions some fountains in *England*, [*qui cum sonitu erumpunt, impetu ferri & fragore ruunt.*] Many hissing springs bubbling at the top, I have found in *Switzerland* (the best water'd Country that ever I saw,) and in many places near the *Rhine*; but I had not opportunities to experiment and Philosophize, upon them. There are other boyling waters of a quite contrary temper, being actually hot to severall degrees, so as to boyl eggs, and many other things put into them; as those near the *Solfatara* not far from *Naples*, before you descend by the little *Capuchin-Cloyster* to *Puzzuolo*, antiently call'd *Puteoli*; as also upon the top of Mount *Zebio* in the *Duke of Modena's Territories*, not far from his villa near *Sassolo*; and in the source of the Emperour's Bath at *Aken*, in the Country of *Juliers*. *Varenius* tell us, [*quod in Japonia fons adeo fervidus, & Ebulliens, prorumpit, ut ignis vehementissimi licet fervore nulla aqua ad eum gradum caloris perducipossit, triplo enim diutius retinere fervorem quam nostra aqua calefacta, consueverit; non fluit continue, sed bis de die per unam horam, & tunc temporis tanto spirituum impetu, & vehementia fertur, ut incumbencia puteo ingentia saxa commoveat, & ad trium vel quatuor ulnarum altitudinem tanto fragore, ut explosionem magni tormenti bellici referat.*

From the foregoing History, we may take occasion to reflect a little upon the manifold Variety of exhalations prepared in, and flying out from the vast *Magazines*, and severall reconditories below, as to their qualities and effects; some being cold, and dry, resembling air, or wind, as those near *Peroul*, and in the Caverns of Mountains, especially those of *Æolus*, and other hills of *Italy*; as also in mines upon the meeting of water; others are inflammable, and of a bituminous nature, though not actually warm, as those near *Wigan* in *Lancashire*; and those as I conjecture, (for I never saw them,) at the much talk't of burning fountain in *Dauphine*: there are also many steams very hot, Sulphureous, and saline; more especially those in the naturall stoves, sweating vaults, grotts, baths, and the *Vulcano's* near *Naples*, *Bajæ*, *Cuma*, and *Puzzuolo*, as also in some of the subterraneous works at *Rome*; others there are of an *Arsenical*, and such like venenose qualities, as in the *Grotta del Cane* on the Bank of the *lago Agnano*; in many mines; in poysonous springs; and lakes; now these various steams meeting with, and running through waters, must cause a great variety of *Phenomena*, and effects in them.

Whether this great diversity proceeds from the Various breaths of the *Pyrites*, and the *lapis Calcareus*, whilst under their different states, and changes, or from other sorts of effluvioms, (the store of nature being vast, and very copious) I dare not determine; however I am convinced that Sulphur is sublimed from the *Pyrites*, according to the opinion of that most excellent Naturalist, and Universally learned Physitian Dr. *Martin Lister*; especially that gather'd upon Mount *Ætna*, *Vesuvius*, the *Solfatara*, (antiently call'd *Campo Phlegreæ*, *Leucogei*, and *forum Vulcani*;) and in the stoves of *S. Gennaro*, not far from thence; for most of the stones and Cinders, thrown out of those mighty furnaces do manifestly contain Iron, if we may believe the Magnet: as to the salt (taken by many
writers

writers to be a sort of *Sal Armoniac*,) found together with the Sulphur in the forementioned places, it appear'd to me to be a kind of *Nitrum Calcarium* for, as I remember, it had not any Urinous qualities, that I could perceive by slight tryalls of mixture; and I was the more confirm'd in my opinion after I had seen, and consider'd, the great quantity of Lime Stone round about *Naples*; many beds of it lying up and down the *Terra di Lavoro*, or *Campania felice*; so that Dr. *Lister's* notions concerning the *Pyrites* and the *lapis Calcarius*, may reach further, and prove in time more fruitfull, then the *Epicureans*, or *Corpuscularians*, may be willing to admit; for other mineralls and metals (at least as many as I know of them,) are not so plentifull as those are, neither are these, or any other bodys whatsoever under ground so sensibly busy, and active in their fermentations, breathings, emanations, and changes, as the *Pyrites*, and the *lapis Calcarius*, are known to be: what there is under our shell, in the deep, and dark regions of the Globe, where humane industry never yet penetrated, I cannot conceive, however I dare not deny, but that all bodys as well above, as under us, may send forth their secret effluviiums, and have their peculiar *Atmospheres*; there being scarce any absolute rest in bodys, as our great and famous Philosopher, Mr. *Boyle* does evince in severall tracts.

*Of the weight of a cubic foot of divers grains, &c.
try'd in a Vessel of wel season'd Oak, whose concave
was an exact cubic foot. By the direction of the
Philosophicall Society of Oxford.*

THE following bodys were poured gently into the vessel, and those in the 12 first Experiments were weighed in scales turning with 2 ounces, but the last 7 were weighd in scales turning with one ounce. The pounds, and ounces here mention'd are Avoirdupois.

- | | lb. | ou. |
|--|------|-----|
| 1. A foot of Wheat (worth 6 ^s a Bushell) weighd of Avoirdupois weight. | 47. | 8 |
| 2. <i>Wheat</i> of the best sort (worth 6 ^s 4 a bushell.) | 48. | 4 |
| 3. The same sort of <i>Wheat</i> measured a 2d time. | 48. | 2 |
| Both sorts were red lammas <i>Wheat</i> of the last year. | | |
| 4. White <i>Oats</i> of the last year. | 29. | 8 |
| The best sort of <i>Oats</i> were 2 ^d in a bushell better then these. | | |
| 5. Blew <i>Pease</i> (of the last year,) & much worm-eaten. | 49. | 12 |
| 6. White <i>Pease</i> of the last year but one, | 50. | 8 |
| 7. <i>Barley</i> of the last year : (the best sort sells for 1 ^s 6 ^d in a quarter more then this :) | 41. | 2 |
| 8. <i>Malt</i> of the last years <i>Barley</i> , made 2 months before. | 30. | 4 |
| 9. Field <i>Beans</i> of the last year but one. | 50. | 8 |
| 10. Wheaten <i>Meal</i> , (unsifted.) | 31. | 0 |
| 11. Rye <i>Meal</i> unsifted. | 28. | 4 |
| 12. Pump <i>Water</i> | 62. | 8 |
| 13. Bay <i>Salt</i> . | 54. | 1 |
| 14. White Sea <i>Salt</i> . | 43. | 12 |
| 15. Sand. | 85. | 4 |
| 16. New-Castle <i>Coal</i> . | 67. | 12 |
| 17. Pit- <i>Coal</i> from Wednesbury 63, but this is very uncertain in the filling the interstices betwixt the greater pieces. | 63. | 0 |
| 11. Gravell | 109. | 5 |
| 19. Wood- <i>Ashes</i> . | 58. | 5 |

A further list of the Specific Gravities of bodys, being in proportion as the following numbers.

P Ump water.	1000.
Fir dry	546.
Elm dry	600
Cedar dry	613
Wallnut tree dry	631
Crab tree meanly dry	765
Ash meanly dry, and of the outside lax part of the tree	734
Ash more dry, but about the heart	845
Maple dry	755
Yew of a Knot or root 16 years old	760
Beech meanly dry	854
Oak very dry, almost worm eaten	753
Oak of the outside sappy part, felld a year since	870
Oak dry, but of a very found close texture	929
The same tryed another time	932
Logwood	913
Claret	993
Moil cider not clear	1017
Sea-water settled clear	1028
College plain Ale the same	1028
Urine	1030
Milk	1031
Box the same	1031
Redwood the same	1031
Sack	1033
Beer Vinegar	1034
Pitch	1150
Pit-Coal of Staffordsh,	1240
Speckled wood of Virginia	1313

Lignum Vitæ	1327
Stone bottle	1777
Ivory	1826
Alabaster	1872
Brick	1979
Heddington stone, the soft lax kind	2029
Burford stone, an old dry piece	2049
Paving stone a hard sort from a- bout Blaidon	2460
Flint	2542
Glass of a quart bottle	2666
Black Italian marble	2704
White Italian marble tryed twice	2707
White Italian marble of another sort of a visibly closer texture	} 2718
Block tin	
Copper	8843
Lead	11345
Quicksilver	14019
Quicksilver	13593

The last Experiment was tryd with another quantity of quicksilver, which had been used in water in the preceding experiment: however I rather trust the last, for that I found a small mistake (tho' here in the calculation allowed for,) in the weight of the glass containig the Quicksilver in the tryal before.

The solids here mentioned, were examined *Hydrostatically* by weighing them in air and water; but the fluids, by weighing an equal portion of each in a glass holding about a quart. The numbers shew the proportion of gravity of equal portions of these bodys: but if of these bodys we take portions equally heavy, their magnitudes will

will be reciprocally proportional to their correspondent numbers. e. g. a cubic foot of water is to a cubic foot of Alabaſter in gravity as 1000 to 1872; but a pound weight of water, is to a pound weight Alabaſter in magnitude, as 1872 to 1000. So that knowing by the former table, the weight of a cubic foot of water, and by this, the proportion in gravity betwixt water and Alabaſter; we may by the rule of 3 find the weight of a cubic foot of Alabaſter, and ſo of any other of theſe bodys; or we may know their magnitude by knowing their gravity. So that an irregular piece or quantity of theſe bodys being offered, 'tis but weighing them, and we may know their juſt magnitude without farther trouble.

A Letter from Dr. Robert Plot of Oxford, to Dr. Martin Lister F. of the R. S. concerning the use which may be made of the following History of the Weather, made by him at Oxford through out the year 1684.

Sir.

IT would be needless to acquaint you with the Universal approbation, your new and easy invention of observing the rise and fall of the *Mercury* in the *Barometer* (by parallel lines drawn from every decimal part of each month of its whole extent,) was received in our *Philosophical Society* at *Oxford*: since I here send you the *Observ.* of a full year made by their order, not only of the rise, and fall of the *Quicksilver*, (markt by the wandering prickt line in the figure belonging to each month,) and the weather; but also how the wind stood each day throughout the whole year, except the Month of *Jan.* which was not thought of at first; though (if we respect the use of such *Observations*,) as material a part as any whatever: for when once we have procured fit persons enough to make the same *Observations* in many foreign and remote parts, how the winds stood in each, at the same time, we shall then be enabled with some grounds to examin, not only the coastings, breadth, and bounds of the winds themselves, but of the weather they bring with them; and probably in time thereby learn, to be forewarned certainly, of divers emergencies (such as heats, colds, dearths, plague, and other epidemical distempers,) which are now unaccountable to us; and by their causes be instructed for prevention, or remedies: thence too in time we may hope to be inform'd how far the positions of the planets in relation to one another, and to the fixt starrs, are concerned in the alterations of the weather, and in bringing and preventing diseases, or other calamities;

lamities; for by this means it is doubtless, that the Learned Dr. Goad of London, has arrived to that pitch of knowledg, he already has, in predicting weather, &c. i. e. by making such old *Almanacks* as this for many years, in stead of new ones; which if once faithfully done in divers parts of the world (as it is now happily begun,) we shall certainly obtain more real and usefull knowledg in these matters in a few years, than we have yet arrived to, in many Centuries: which no question was the opinion of the industrious *Walter Merle* Fellow of *Merton Coll.* who thus observed the weather here at *Oxford* every day of the month, seven years together viz. from *Jan. 1337* to *Jan. 1344*; the MS. Copy of which *Observations* are yet remaining in the *Bodleian Library*; and doubtless 'twas some such consideration as this, that moved *Erasmus Bartholin* to make *Observations* of the weather every day of the month through the whole year 1671 which are printed *inter Acta Medica Tho Bartholini*. Now Sir if these worthy *Gent.* thought it worth their while, laboriously to make such *Observations* without the helps that you have afforded us; how supine had we been, if we had forborn to prosecute it; I am sure I could not have thought myself otherwise, had I neglected it, after I had received the commands of so judicious a *Society*; and the rather because then too, I should have rudely slighted an *Invention* of yours, who have always afforded me the inestimable Character of

Your most faithfull
Freind Rob. Plot.

Observations of the Wind, Weather, and height of the Mercury in the Barometer, throughout the year 1684; taken after Dr. Lister's method, in the Musæum Ashmoleanum, at the request of the Philosophicall Society of Oxford; by Robert Plot, LLD.

A Scheme of the weather at Oxford; 7 January; 1684.

<i>Day.</i>	<i>Weather.</i>
1	hard, frost and fair.
2	frosty, but yielding a little towards night.
3	rimy frost.
4	hard frost, and fair.
5	hard frost, and fair.
6	hard frost, and fair.
7	hard frost, but a little yielding at night.
8	rimy frost morn. fair all day, windy night.
9	frost, but snow at night.
10	cold raw weather toward noon, rain toward night.
11	moist thawing weather.
12	close thawing weather.
13	moist, close weath. a small frost at night.
14	close frosty weather.
15	close frosty weather.
16	close frosty weather, at night windy.
17	frost, at night snow.
18	snow, and wind.
19	close sharp weather.
20	close <i>ut supra</i> but a little yield. at night.
21	mild frost, and fair.
22	hard frost, snow at night a little.
23	hard frost.
24	hard frost, and fair.
25	hard frost, and snow.
26	frost, a little snow.
27	frost, a little thaw about noon.
28	frost, and fair.
29	frost, a small thaw all the afternoon.
30	hard frost, and fair.
31	frost, and fair.

A Scheme

A Scheme of the Wind, & Weather at Oxford; February; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	NE	frost, and fair.
2	NE	frost, a little thaw at night.
3	due E	frost, and fair.
4	due S	close wea. & a little thaw & Snow at ni.
5	S W	thawing weather, wind & rain at night.
6	due W	fair clear weather.
7	due W	close thawing rainy weather.
8	N & by W	close weather.
9	due S	fair in the morn. rain & snow at night.
10	due S	close wet weather.
11	due S	fair morning, wet at night & windy.
12	SSW	close morning, fair at night.
13	N & by W	close morning, fair at night.
14	W & N	rain morning, fair at night.
15	N W	fair weather.
16	due S	rainy morning, close at night.
17	S W	close moist weather.
18	S W	rainy and wind.
19	due W	moist morning, fair afternoon.
20	W S W	open fair weather.
21	S W	close weather, windy.
22	W S W	close rainy weather.
23	due W	wet morning, fair afternoon.
24	W & by S	fair morning, close Evening.
25	S W	fair morning, close evening.
26	S. W	wet morning, close evening.
27	S E	wet morning, fair evening.
28	N E	close frosty weather.
29	E & by S	frosty clear weather.

A Scheme

A Scheme of the Wind & weather at Oxford; March; 1683.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	S E	close frosty cold weather
2	N E	close cold weather
3	N & by W	close frosty weather.
4	N & by W	close cold weather,
5	due N	close morning, snow evening
6	N E	close cold weather.
7	N N E	frost fair and windy.
8	N N E	frost, close and windy.
9	E & by N	frost and high winds
10	E N E	close frosty cold weather.
11	N & by W	frost and fair, close at night.
12	due N	frosty, snowy, windy weather.
13	N & by E	frost morning, fair night.
14	N & by E	frost, snow & wind.
15	N N E	snow & wind,
16	N N E	snow and rain.
17	N & by E	close moist weather.
18	W & by N	close morning fair night.
19	N E	cold changeable weather.
20	N N W	snow and cold high winds.
21	N E	close but fair weather.
22	N E	fair weather, but cold.
23	E & by N	cold fair weather.
24	E & by N	cold fair weather.
25	E & by N	cold fair weather.
26	due E	cold fair weather.
27	due E	cold close weather.
28	S & by W	warm moist weather.
29	S & by W	wind and rain.
30	S & by W	close fair weather.
31	due S	fair calm weather.

A Scheme of the Wind, and Weather at Oxford; April; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	N & W	fair sun-shine weather.
2	W & by N	rain i'th morning, fair evening.
3	S & by W	fair morning, wind and rain at night.
4	S & by W	close moist weather.
5	S W	rainy weather.
6	due W	fair morning, wet at night.
7	due W	fair weather.
8	S W	close weather.
9	N W. & N	close weather but fair.
10	N E	close fair weather.
11	due E	rain and wind moderate
12	N & W	close cold weather
13	N & by E	fair sun-shine weather.
14	E N E	fair morning, close evening.
15	NE & by E	close cold weather.
16	E & by N	close cold weather.
17	E & by N	close cold weather.
18	S & W	variable dry weather.
19	due S	moist morning, wet night.
20	SE & SW	close warm weather.
21	S E	fair sun-shine weather.
22	S. N. E	fair morn. inclinable to rain at night.
23	S W	rainy morning, fair evening.
24	S W	fair sun-shine weather.
25	S W	fair sun-shine weather.
26	due S	close dry weather.
27	S W	fair sun-shine weather.
28	S W	close dry weather.
29	S W	close dry weather.
30	due S	rain morning, fair evening

A Scheme of the Wind, and Weather at Oxford ; May ; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	SSW	Variable weather.
2	due W	fair weather.
3	SSW	close fair weather.
4	WSW	close fair weather.
5	WSW	moist morning, fair evening.
6	WSW	close fair weather.
7	WSW	close morning, rain at night.
8	SSE & SW	fair warm weather.
9	NW	close fair weather.
10	due W	close fair weather.
11	due W	close fair weather.
12	due W	misty morning, fair evening.
13	S & W	wet morning, fair evening.
14	SW	close weather, some rain.
15	due N	close fair weather, some wind.
16	NNE	windy morning, close evening.
17	NE	close dry weather.
18	NE	close fair weather.
19	NE	fair sun-shine weather.
20	E & by N	close fair weather, some wind.
21	NE	warm morning, close evening.
22	NE	close, fair, and windy.
23	NE	close, fair, and windy.
24	NE	close morning, fair sun-shine evening.
25	NE	close fair weather.
26	SE	fair sun-shine weather.
27	NE	close fair weather.
28	E & by N	fair sun-shine weather.
29	SW	wind and rain.
30	due W	close fair weather.
31	SW	close weather, a little rain at night.

A Scheme

*A Scheme of the Wind, and Weather at Oxford ; June ; 1684.**Day. Wind.**Weather.*

1	S W	close morning, fair evening.
2	due W	close morning, rainy evening.
3	due W	fair morning, rainy evening.
4	due W	close fair weather.
5	due W	close fair weather.
6	due W	close fair weather.
7	W, & N	close fair weather.
8	due N	fair sun-shine weather.
9	due N	close fair weather.
10	N E	fair sun-shine weather.
11	due E	fair sun-shine weather.
12	due E	fair sun-shine weather.
13	E S E	fair sun-shine weather.
14	E S E	fair sun-shine weather.
15	E S E	fair sun-shine dry weather.
16	E S E	fair sun-shine hot weather.
17	E S E	fair sun-shine hot weather.
18	E by N	sun-shine morning, cloudy evening.
19	E by N : S S W	sun-shine hot weather.
20	S by W	a little rain. cloudy.
21	S E : E S E	lowring. some rain.
22	N E	fair hot weather.
23	N E	hot. a muddy sky.
24	N E	sun-shine clear.
25	N E	sun-sh fair weather.
26	N E	sun-shine dry weather.
27	N E : E	very dry.
28	E : S E	hot lowring evening.
29	S : S W	sun-shine clear.
30	S W	cloudy, cool.

A Scheme of the Wind, and Weather at Oxford, July, 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	SW. WNW	somewhat cloudy.
2	W	a little rain, fair.
3	S W	fair, but cloudy.
4	S W. W	close, some rain.
5	S W	sun-shine morning, gloomy evening,
6	S W	close.
7	W S W	cool. close.
8	S W	hazy. some rain.
9	W. N W	some rain. clear.
10	N W	clear sun-shine.
11	S W	rain.
12	W	some rain. fair evening.
13	W	a shower or two.
14	W: S W	cool close weather.
15	W S W	rain
16	W	cool close weather.
17	W	cool close weather.
18	N: W	fair sun-shine weather.
19	W S W	lowring cool weather.
20	W: N W	fair sun-shine weather.
21	W	fair sun-shine weather.
22	W	hot sun-shine weather.
23	W: S	hot sun-shine weather.
24	S: E	hot sun-shine weather.
25	E & by S	hot sun-shine weather.
26	E & by S	hot, a little rain toward night.
27	W: N	hot sun-shine weather.
28	W	hot. thunder. rain.
29	N N E	cloudy, some rain.
30	N N E	fair sun-shine weather.
31	N E	hot sun-shine weather.

A Scheme of the Wind, & Weather at Oxford; August; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	N.	warm sun-shine weather.
2	W.	cool fair weather.
3	S W	warm fair weather.
4	due S	hot sun-shine weather.
5	S W & by S.	hot sun-shine weather.
6	S W & by S	warm sun-shine weather.
7	due S	rainy morning, fair evening,
8	due S	close fair weather.
9	due W	fair sun-shine weather.
10	due N	fair sun-shine weather.
11	S W	fair morn.inclinable to rain at night
12	due W	rainy morn.the same in the evening.
13	due W	fair sun-shine weather.
14	due W	fair sun-shine weather.
15	W	fair sun-shine weather.
16	W:N	a showr. sun-shine weather.
17	N W	sun-shine morning, cloudy evening.
18	N N W:N	a muddy sky in the morn.f. sh. even.
19	N. S W	fair sun-shine weather.
20	S S W	hot sun-shine weather.
21	S S W	hot sun-shine weather.
22	S W	fair sun-shine weather.
23	S W	hot sun-shine weather.
24	S W	hot sun-shine weather.
25	N	rain all day.
26	S W	rain at night.
27	N W	close; some rain.
28	S W	close weather.
29	S S W	close; rain at night.
30	due S	variable weather.
31	S & by E	close; some rain.

A Scheme of the Wind & Weather at Oxford; September; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	S & by E	close, some rain.
2	due S	close, some rain,
3	S E. W	close, rain, thunder.
4	S E: S W	close, some rain.
5	due E	close morning, rain afternoon.
6	S S E	close, some rain.
7	N W	fair sun-shine weath. rain at night.
8	N W	fair close dry weather.
9	N W	sun-shine morning, close evening.
10	N W. N E	sun-shine morning, some rain.
11	W & by N	fair morning, close evening.
12	N W: N	fair morning, some rain at night.
13	N N W	rainy weather.
14	due N	fair sun-shine weather.
15	N & by E	fair sun-shine weather.
16	due N	close fair weather.
17	N W	close, and windy.
18	due N	fair, morn. some rain; fair again.
19	due N	fair morning, close evening.
20	due S	fair sun-shine weather.
21	S & by E	fair sun-shine weather.
22	due S	fair sun-shine weather.
23	S & by W	fair morning, close evening.
24	due W	fair sun-shine weather.
25	S & by W	changeable weather.
26	due S	changeable weather.
27	due S	rainy weather.
28	due S	close moist weather.
29	S W	close moist weather.
30	N W	close morning, sun-shine evening.

A Scheme of the Wind, and Weather at Oxford; October 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	N W	moist weather, some rain.
2	W & by S	close weather, but fair.
3	S W	close morning; fair evening.
4	S & by W	close all day, rain at night.
5	W: N W	rainy morning, fair evening.
6	due W	rainy windy weather.
7	S & by W	rain all day.
8	N N W	rain morning, fair evening.
9	N: N N W	close fair weather.
10	N W	fair weather.
11	S W	windy rainy morning, fair evening.
12	S S W	close and some wind.
13	S S W	close, some rain.
14	S S W	rain, and wind.
15	S & by E	wind, and rain.
16	S S W	fair sun-shine weather.
17	S W	fair sun-shine weather.
18	W & by N	fair weather.
19	N W	close morn. fair sun-shine evening.
20	N W	fair weather.
21	due W	fair sun-shine weather.
22	due W	close fair weather.
23	due W	fair morning, wind & rain at night
24	N W	wind, snow, & rain.
25	N W	close, cold, and windy.
26	N W	fair frosty weather.
27	N E	frost, and snow.
28	S: W: N	frost, and snow.
29	N: W	frosty cold weather.
30	N: W	snow, and wind
31	due N	cold thaw in the M. clear frosty E.

A Scheme

A Scheme of the Wind, and Weather at Oxford; Novem.; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	S & by W. N	thaw, snow, frost.
2	N W: W.	frost: morning, thaw afternoon.
3	S & by W: W	thawing weather all day.
4	N W	close, and windy.
5	N W.	close, and windy; little frost.
6	due W.	fair weather, little frost.
7	N: S.	fair morning, rain evening.
8	E & by S	small rain all day.
9	S E.	misty moist weather.
10	due W.	rainy misty weather.
11	N W.	cloudy moist weather.
12	S W.	cloudy moist weather.
13	S W	cloudy, some sun-shine.
14	S W	close, a mist at night.
15	N W	frosty morning, close evening.
16	N W.	close morning, clear frosty evening.
17	N W: N.	hard frost and clear.
18	N.	hard frost, sun-shine.
19	S	close. snow. rain.
20	S	much rain.
21	W	warm sun-shine weather.
22	S	frost, rain.
23	S W	fair, somewhat warm.
24	W S W	some rain.
25	W N W	close. fair.
26	W	fair. warm. close.
27	N W	some rain.
28	N	cold. cloudy. rain.
29	N E	fair, but cloudy.
30	N	fair.

A Scheme of the Wind, and Weather at Oxford, Decem.; 1684.

<i>Day.</i>	<i>Wind.</i>	<i>Weather.</i>
1	N N E	frost. sun-shine.
2	N	frost. sun-shine.
3	W S W	fnow. much small rain.
4	S	cloudy. some rain.
5	S	warm sun-shine weather.
6	SE: E N E.	misty. thick moist air.
7	E N E	frost. sun-shine weather.
8	E N E	moist cloudy air.
9	E N E	moist cloudy air.
10	E N E	thick, moist air.
11	E N E	fair but cloudy.
12	E N E	close.
13	E N E	a moist close air.
14	E S E	frost. clear sun-shine.
15	E: W S W	frost. cloudy.
16	N W: N	frost. cloudy.
17	W	frost. cloudy, a little snow.
18	N	frost. sun-shine.
19	W	thaw. cloudy.
20	N N W	rain. hail. snow.
21	W	frost. sun-shine.
22	N	frost. sun-shine.
23	E	hard frost. windy.
24	N E	frost. sun-shine.
25	N	frost. cloudy, much snow.
26	N	hard frost. sun-shine.
27	W	frost. sun-shine.
28	N W	rain all day.
29	N W	frost. rain at night.
30	W N W	some rain. fair evening.
31	E	fair. cloudy.

An Abstract of a Letter from Dr Peirce of Bath, to one of the S. of the R. S. giving an instance of the effects of the Bath in curing the Palsy, and Barrenness.

AMong the many Diseases these waters have been famous for the cure of, Palsys and Barrenness are two; an instance of both, in one person, I shall now give you. A Gentlewoman of about 30 or 32 years of age, having been married about 10 or 12 years, and never with Child, was suddainly seized with a Palsy on the left side; for which after 8 or 10 months tryal of other means, to little purpose,) she was brought to the Bath, where (after usual preparations, and some internal means,) she continued that season, about 6 weeks; the winter coming on shee was forced to desist; but (by the advantage shee received,) was encouraged to come very early the next year, and did continue with us the whole summer, and recovered, in great measure, the use of her arm, and hand, leg, and tongue; and not only so, but (in a few weeks, after shee returned to her husband,) conceived with Child, and had (at about a year and halfs distance between them,) 5 Children, following. Since I received your Letter, being at Wells (where shee now lives,) I went to see her; she shewed me 4 of the Children, lusty and strong and well grown for their age; the fifth dyed. Shee her selfe hath no return of a Palsy but is infirm, I think consumptive; she is now about 51 years old.

Caroli Dre-

Caroli Drelincurtii Experimenta Anatomica, quibus adiecta sunt plurima Curiosa super Semine Virili, Fæmineis Ovis, Utero, Uterique Tubis, atque Fætu. Lugd. Bat. 1684, 12°.

THE former, and greater part, of this Book, contains accounts of experiments on Dogs; in which we find the following Observations.

A Mastiff bled five pound (Troy weight.) of blood, within the space of half an hour, at severall Arteries.

The Ribs of a Dog were found more brittle near that end by which they are joyned to the *Vertebræ*, then at the other end.

A needle being driven into the Brain of a Dog, between the first *Vertebra*, and the *Os Occipitis*, the Dog seem'd as if struck with an Epilepsy, and died in a little time.

The passage from the *Pelvis* into the *Ureter* of a Dog, being stop't, the Kidney of the opposite side was found larger then ordinary,

Six veins being tied in a Dog (*viz.* the 2 *Crurales*, the 2 *Axillares*, and the externall *Jugulars*,) the Dog seem'd choak'd in a very little time; the Ligatures being loos'd, and blood drawn, the breast moved again.

A *Procidencia Ani* has been caus'd in a Dog, to the length of a foot. A Dog not much troub'd at the pricking of the *Meninges*, was concern'd when the spinal marrow was pierc'd. Experiments have been tried by the Author, with Tallow injected into the veins of Dogs.

The *Venæ Mammariæ* have been observed to communicate with the *Epigastricæ* in a Bitch; for blood was easily press'd from the former into the latter, and back again.

A Phial, which, when fill'd, contain'd a pound of rain-water, held one pound and one ounce of Venose blood, of

Arterioſe blood, and of ſerum taken promiſcuouſly from both ſorts of blood; but it held one pound one ounce and half of grumouſe blood, clear'd of the ſerum.

The Author affirms that no Lacteals ariſe either from the ſtomack, or *Inteſtina Crassa*.

Valves are obſerv'd in the farther part of the *Ductus Thoracicus*, near its ending in the *Subclavial Vein*; contrary to what is affirm'd by ſome Anatomists.

The Valves, lying in pairs in the *Ductus Thoracicus*, are generally an Inch and half one pair from another. One Kidney has been found 8 times bigger and heavier, in a Dog, then the other.

The Author aſſerts that the Lacteals impart no Liquor to the *Pancreas Afellii*.

Their Origine has been traced as far as the *Glanduloſe Tunic* of the Inteſtines.

There are ſeverall other obſervations mentioned, concerning the Lacteals, the *Ductus Thoracicus*, and the valve at the end of it; beſide all which the Publiſher of this book, *Erneſtus Gotfried Heyſeus* of *Dantzick*, aſſures us, that the learned Author has a vaſt ſtock of Obſervations by him; which very much advance Phyſiological, and Pathological Phyſic, and as ſuch cannot but be very welcome to the Curious Reader, when ever the Author ſhall think fit to preſent them to the world.

There follow ſeverall Quæries de *Semine Virili*; de *Fæmineis Ovis*, vel in *Ovario*, vel *extra*; de *Utero*: to which are ſubjoyned ſome Corollarys concerning the Human Fætus, whom he will not allow to have a *Allantois*, or *Urachus*.

E R R A T A.

P Ag. 862 line 2 for *Loir* read *Lers*. pag. 863 line 12, for *Mago*, read *Mayo*. pag. 888 line 25 for *anatomized* read *anatomized*. line penult read *th uſand million of paris*. pag. 893 line 21 for *from* read *from*. pag. 894 line 25 for *aſer* read *aſter*. pag. 900 line ult read *abſolutely*. pag. 919 read intelligible. pag. 921 line 16 read *obſervati*. page 923 line 8 for *was* read *as*. pag. 924 line 32 for *Campo* read *Campi* pag. 928 line 29 read *containing*. pag. 932, line 7, read *hard froſt*.

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PHILOSOPHICAL

TRANSACTIONS.

April 20th. 1685.

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S

Of the Bogs

Of the Bogs, and Loughs of Ireland by Mr. William King, Fellow of the Dublin Society, as it was presented to that Society.

WE live in an *Island* almost infamous for *Bogs*, and yet, I do not remember, that any one has attempted much concerning them; I beleive it may be of use to consider their Origine; their conveniencys, and inconveniencys; and how they may be remedied, or made usefull.

I shall give you my thoughts, and observations on each of these; tho' I am satisfyd, that what I shall be able to say, will be very little, in respect of what would be required, on such an important subject, and so very necessary to the improvement of the Kingdom. As to the *Origine* of *Bogs*, it is to be observed, that there are few places, in our northern world, but have been famous for *Bogs*, as well as this; every barbarous ill-inhabited country has them. I take the *Loca palustria*, or *paludes*, to be the very same we call *Bogs*: the ancient *Galls*, *Germans*, and *Britans* retiring, when beaten, to the *paludes*, is the very same that we have experienced in the *Irish*, and one shall find those places in *Italy*, that were barbarous, such as *Liguria*, were infested with them; and therefore I beleive the true cause of them is want of industry; at least industry may remove, much more prevent them. There are many *Bogs* of late standing in *Ireland*; when *Odonal* and *Tirone* came to the relief of *Kingsale*, they wasted the Country, especially as they came thro' *Connaught*, which by the means of the *Earl of Clanrichard*, was generally loyall; and there is a great tract of ground now a *Bog*, that was then plowed land; and there remains the mansion house of my Lord-----in the midst of it: now if want of industry has in our remembrance made one *Bog*; no wonder

der is a Country, famous for laziness, as *Ireland* is, abound with them. To shew you, how want of industry causes *Bogs*, you must remember, that *Ireland* abounds with springs; that these springs are generally dry, or near dry, in the Summer time and the Grass, and weeds grow thick about the places where they burst out. In the winter they swell; and run and soften, and loosen all the Earth about them; now that sward or scurf of the Earth, that consists of the roots of grass, being lifted up and made fuzzy by the water in the winter, (as I have at the head of some springs seen it lift up a foot or two,) is dried in the spring; and doth not fall together, but wither in a tuft, and new grass springs through it; which, the next winter is again lifted up, and so the spring is more and more stopt, the scurf grows thicker and thicker till at first it make that which we call a *quaking Bog*: and as it grows higher, and dryer, and the grass roots and other vegetables become more putrid together with the mud and slime of the water it acquires a blackness, and grows into that which we call a *turf Bog*. I believe when the vegetables rot the saline particles are generally washed away with the water, as being apt to be diluted in it; but the oily or sulphureal are those that chiefly remain, and swim on the water, and this is that which gives turf its inflammability. To make this appear, 'tis to be observed that in *Ireland* our highest mountains are covered with *Bogs*, as well as the plains; because our mountains abound more with springs than could be imagined: I remember one high mountain, in the north of *Ireland*, has 4 *Loughs* on the side of it near the top; now no body living on our mountains; and no care being taken to clear the springs, the whole mountains are overrun with *Bogs*, as I have described.

2, It is to be observed, that *Ireland* doth abound in moss more than, I believe, any Kingdom; in so much that it is very troublesome, being apt to spoil fruit trees,

and quickfets; I do not remember, that they, who have written of Gardening, or Orchards, mention it, which I am sure they would, had they bin as much troubled with it, as we are; now this moss is of divers kinds, and that which grows in *Bogs* is remarkable, your light spongy *turf* is nothing but a congeries of the threds of this moss, as I have frequently observed, before it be sufficiently rotten, (and then the *turf* looks white and is light,) I have seen it in such quantities and so tough that the *turf* spades, could not cut it: in the north of *Ireland*, they, by way of joque call it *old wives tow*, and curse her that buried it, when it hinders them in cutting the *turf*, it is not much unlike flax: the *turf*-holes in time grow up with it again, and all the little gutters in *Bogs* are generally filled with it; and truly I chiefly impute the *red*, or *turf Bog*, to it; and from it even the hardened *turf* when broken, is stringy; tho' there plainly appear in it parts of other vegetables: it is observable that both vegetables and Animals have very different forms, when they are kept under and when out of the water; & I am almost (from some observations,) tempted to believe that the seed of this *Bog-moss*, when it falls on dry and parched ground begets the *Heath*: however the moss is so fuzzy and quick growing a vegetable, that it mightily stops the springs, and contributes to thicken the scurf especially in *red Bogs*, where only I remember to have observed it.

3, It is to be observed, that the bottom of *Bogs* is generally a kind of white clay, or rather sandy marle; a little water makes it exceeding soft; and when it is dry it is all dust; and this contributes much to the swelling of the *Bogs*; for the roots of the grass do not stick fast in it; but a little wet loosens them, and the water easily gets in between the surface of the earth and them, and lifts up the surface, as a dropsey doth the skin.

4, 'Tis to be observed, that *Bogs* are generally higher
then

then the land about them, and highest in the middle: the chief springs that cause them being commonly about the middle, from whence they dilate themselves by degrees, as one would blow a bladder; but not always equally, because they sometimes meet with greater obstacles on one side, then on the other: whoever has seen *Bogs*, cannot doubt of this; and besides if you cut a deep trench thro' a *Bog*; you will find the originall spring, & vast quantities of water will run away, and the *Bog* subside; the *Bog* at *Castle Forbes*, (as I was informed,) subsided 30 foot; I could hardly believe that; but found by computation, that it could not be much less then half of it: I believe, these, and other observations that might be made being laid together, it is hardly to be doubted, but that I have given the true origine of *Bogs*: those hills, that have no springs, have them not; those that have springs, and want culture, constantly have them: where ever they are, there are great springs: the turf generally discovers a vegetable substance: it is light, and impervious to the water; the ground under it is very pervious: and all these are plainly accountable from the causes I have given.

I must confess there are *quaking Bogs*, caused otherwise; when a stream, or spring runs thro' a flat; if the passage be not tended, it fills with weeds in Summer, trees fall a cross it, and dam it up; then, in winter, the water stagnates farther & farther every year, till the whole flat be covered; then there grows up a course kind of grass peculiar to these *Bogs*; this grass grows in tufts, and their roots consolidate together, and yearly grow higher, in so much that I have seen of them to the height of a man; the grass rots in winter, and falls on the tufts, and the seed with it, which springs up next year, and so still makes an addition; some times the tops of flags and grass are inter-woven on the surface of the water, and this becomes by degrees thicker, till it ly like a cover on the water; then herbs take root in it, and by a

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plexus

plexus of the roots it becomes very strong, so as to bear a man; I have gone on *Bogs* that would rise before and behind, and sink where I stood to a considerable depth; under was clear water, as some of us experienced by falling in with one leg up to the middle, and that by breaking the surface of the earth where we stood: even these in time will grow *red Bogs*; but may easily be turned into meadow, as I have seen severall times, meerly by clearing a trench to let the water run away.

The inconveniences of these *Bogs* are very great; a considerable part of the Kingdom being rendered useless by them; they keep People at a distance from one another, and consequently hinder them in their affairs, and weaken them; for it is certain, that if suppose a 1000 men live on 4 contiguous acres, they can both better assist, and defend one another, then if they lived on 4 not contiguous: and therefore it were good for *Ireland*, the *Bogs* were sunk in the Sea, so their good land were all contiguous; but it is further observable here, that generally the land, which should be our meadows, and finest evenest plains, are covered with *Bogs*; this I observed thro all *Connough*, but more especially in *Longford* & likewise in *West Meath* and in the North of *Ireland*. These *Bogs* are a great hindrance in passing from place to place; in as much as that you are forc't to go far about to avoid them, and on this account the roads are very crooked in *Ireland*; or forc't (by vast charges to the country,) through *Bogs*; by these means they are long, and hard to find.

The *Bogs* are a great destruction to Cattle, the cheif commodity of *Ireland*; in the spring time when the Cattle are weak and hungry, the edges of the *Bogs* have commonly grass; and the Cattle venturing in to get it, fall into pits or sloughs; & are either drown'd, or (if they are found,) spoilt in the pulling out; the number of Cattel lost this way is incredible.

4. They are a shelter and refuge to *Torys*, and *Thieves*, who can hardly live without them. The

5, The smel and vapours that are from *Bogs*, are accounted very unwholsome; and the fogs that rise from them are commonly putrid, and stinking: for the rain, that falls on them, will not sink into them; there being hardly any substance of its softness, more impenetrable by water, then turf, and therefore rain-water stands on them, and in their pits; it corrupts there, and is exhaled all by the Sun, very little of it running away, which must of necessity affect the air.

6, They corrupt our water, both as to its colour, and taste; for the colour of the water that stands in the pits, or lyes on the surface of the *Bog*, is tinged by the reddish black colour of the turf; and when a shower comes, that makes these pits overflow, the water that runs over tinctures all it meets, and gives both its colour and stink, to a great many of our rivers; as I observed thro' all the North of *Ireland*.

The Natives heretofore had nevertheless some advantage by the woods, and *Bogs*; by them they were preserved from the conquest of the *English*; and I believe it is a little remembrance of this, makes them still build near *Bogs*: it was an advantage then to them to have their country unpassable, and the fewer strangers came near them, they lived the easier; for they had no inns, every house where you came, was your inn; and you said no more, but put off your brogues & fate down by the fire; & since the natural *Irish* hate to mend high ways, and will frequently shut them up, and change them, (being unwilling strangers should come and burthen them;) Tho' they are very inconvenient to us, yet they are of some use; for most of *Ireland* have their firing from them; Turf is accounted a tolerable sweet fire, and we having very impolitickly destroyed our wood, and not as yet found stone coal, save in few places, we could hardly live without some *Bogs*: I have seen turf charc'd,

it serves to work iron, and as I have bin informed, will serve to make it in a bloomery or iron-work : turf charc-ed I reckon the sweetest and wholsomest fire, that can be; fitter for a Chamber, and consumptive People, then either wood, stone-coal or char-coal.

I know not if it will be worth the observing, that a *Turf-Bog* preserves things strangely, a Corps will ly intire in one, for severall years; I have seen a piece of leather pretty fresh dug out of a *Turf-Bog*, that had never in the memory of man been dug before; Butter has bin found, that had lain above 20 years, and tho' not fit to be eaten, yet served well enough to greaze wool : Trees are found found, and intire in them, and those Birch, or Alder that are very subject to rot. The Trees are supposed by the ignorant vulgar to have lyen there ever since the Flood, but the truth is, they fell on the surface of the Earth; and the *Bog*, as I shewed in the beginning of this discours, swelling by degrees, at last covered them; and being of an oily vegetable substance, it, like a balsam, preserves them; the Trees burn very well and serve for torches in the night : I have seen them usd as Lights in catching of Salmons: I have seen of the Trees half sunk into the *Bogs*, and not quite covered.

I am in the last place to shew you how these inconveniencys may be remedied, and our *Bogs* made usefull; 'Tis certain the thing is possible; it has bin done in *England, France, and Germany*; and if we had the same industry we may promise our selves the same success. I know men commonly distinguish between *Bogs* that have no fall to carry away the water from them; and those that have; and determine the last drainable, but not the first : but I must profess I never observed one *Bog* without a fall sufficient to drain it, nor do I believe there is any. But the great and weighty objection against them is the charge; and it is commonly thought, that it will cost much more then would purchase an equal scope of good
good

good ground; an acre of good land in most parts of *Ireland* is about 4^s per annum, and the purchase 14, or 15, years; & therefore three pound will purchase an acre of good land; and it is very doubtfull with most, whether that sum will reduce a *Bog*: this reasoning passes current, and is the great obstacle and impediment of this work; but if these things following were done and considered, I verily believe it would be removed.

1, An act of Parliament should be made, such as was for the building of *London*; that who did not in such a time, make some progress in draining their *Bogs*, should part with them to others that would, & allow a passage to them thro' their lands: rather then Gentlemen would let others come into their bounds, they would purchase their *Bogs* at double the rate, as they doe patches of land within them.

2dly 'Tis to be considered, that *quaking Bogs*, tho' land be never so cheap; never fail to be worth the draining; one trench drains many acres; and when dry, it is generally meadow, or the best grazing ground.

3dly Every *red Bog* has about it a deep marshy sloughy ground, which they call the *bounds* of the *Bogs*, and which never fails to be worth the draining: one deep trench round the *Bog*, doth it; by this Cattle are kept out of the *Bog*, and all the bounds of the *Bog* turned into meadow as I have frequently seen.

4thly As to *red Bogs*, I remember one of 60 acres, which a Gentleman drained; the land about it was 4^s, 9^d per acre; it was not worth any thing, but rather pernicious to his Cattle; he reduced it to good grazing ground worth 3^s an acre, for 25*l*; which is less then 3 years purchase.

5thly Gentlemen ought to consider, that what they lay out this way, goeth by degrees, and they are not sensible of it; it goeth among the Tenants, and enables them to pay their rent the better: 'tis a work of charity, and

employs hands, and conduces to both the ornament & generall profit of the Kingdom; and therefore they ought to dispense with it, tho' somewhat dear.

6thly That even *red Bogs* might be made fit for grazing, at a much cheaper rate, then they have bin hitherto, if these rules were observed: 1 a deep trench must be made round the *Bog*, as before; this reduces all the bounds of the *Bogs*, goes a great way to dry the *Bog* it self; and hinders at least its growing: it serves likewise as a common sink, into which all your drains vent themselves.

7thly in the *Bog*, observe which way the little *Sloughs* run; be sure to cut their drains a cross them; one drain so cut doth more, then 3 or 4 long ways; as I saw by Experience.

3dly the first drains on the *Bog*, ought not to be above 2 or 3 foot deep or wide; deep trenches ought by no means to be attempted at first; for the *Bog* is so soft, that they will not stand, but fill up again; neither can any body stand well in them to cut them deep: but when the surface of the *Bog* is cut in little trenches suppose at 20, or 40 perch, distance, it is hardly credible how much it will be dried: I remember such a little trench, drawn thro' a *Bog*, that was very wet, dried it, so that Cattle could graze on it all Summer; and the *Bog* subsided, for an hundred yards, on each side, so visibly, that one would have believed it a naturall valley.

4thly a year or 2 after the little trenches are made, & the *Bog* a little dry; they are (at least every other trench as one sees occasion is,) to be made six foot deep and six wide, if the softness of the *Bog* will permit; if not, then six foot wide and 4 deep is enough; and this will certainly make the *Bog* usefull for grazing: in a year or 2 after, you may attempt to cut one or two of the trenches to the bottom of the *Bog*; for till that be done, I do not reckon the *Bog* secured.

5thly A Gentleman ought to oblige all his Tenants to
cut

cut the turf in his trenches, and likewise cut his own so, for this is just so much gain, and prevents that pitting of *Bogs*, that renders them deformed & pernicious to Cattle.

6thly Where a *Bog* is pitted, he is to cut a passage from one pit to the next for the water, and so make a communication to the common drain, and if his pits be once dried there will grow grass or heath at the bottom, fit for grasing; and they will be shelter for Cattle in storms.

7thly When his *Bog* is dried, it is thereby made better turf: and then he is to set out a part of it for that use, and to oblige them to cut it clear away; and the *Bog* being removed, the bottom will make good meddow: as I have seen in the County of *Longford*.

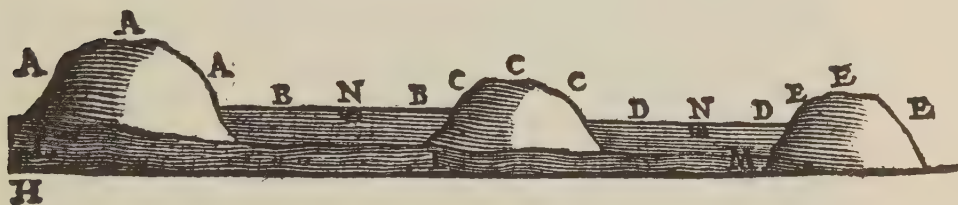
8thly if he would improve his *Bog* any further then grasing; he must do it either by cutting off the surface of the *Bog* and burning it, or else by bringing Earth and laying on it: Sanding or rather indeed Gravelling is a great improvement in this country; the land so manured will bring corn 12 or 14 years, and would bring grass, if People did not Plow it so long, as to consume all the substance of it, and destroy the roots of the grass, which are not to be recovered in many years, and then they say gravelling is bad for grass; but the contrary is apparent, especially in *Bogs*. I have observed by the way side where those ways pass thro' *Bogs*, if a little Earth hath fallen on the *Bog*, as some times there doth fall a little of that which they bring to mend the high way, it has turned the *Bog* into a green sod, with a very fine scutch grass on it: and I doubt not but the same charges, that Sands or Gravels land, would reduce a dried *Bog*; even to be arable; but this requires time and experience, which I doubt not but will find out many compendious and easy methods of performing these things, more then we can think of.

Twere naturall to add some thing concerning *Loughs*,
and

and *Turloughs*: the naturall improvement of *Loughs*, or lakes, is first to drain them as low as we can; and then turn the residue of the water into fish-ponds, by planting a few Trees about them, and ordering them thus they may be made both usefull, and ornamentall.

As to those places we call *Turloughs*, *quasi Terreni lacus*, or *land-lakes*; they answer the name very well, being lakes one part of the year of considerable depth; and very smooth fields the rest: if my memory dos not fail me, Doctor *Brown* describes exactly the like in *Hungary*, or else in the way between *Vienna & Venice*: there are in these, holes out of which the water riseth in winter, and goeth away towards Summer, many hundred acres being drowned by them; and those the most pleasant, and profitable land in the country: the soil is commonly a marl, which, by its stiffness, hinders the water from turning it into a *Bog*; and immediatly when the water is gone, it hardens, so that you ride thro' an even grassy field; these, if they could be drained would be fit for any use; would make meddow; or bear any grain, but especially rape, which is very profitable. They are chiefly in *Connaught*; and their cause is obvious enough, it is a stony hilly Countrey; the hills have cavities in them, through which the water passes: it is common to have a rivulet sink on one side of a hill, and rise a mile, or half a mile, from the place: the brooks are generally dry in Summer; the water that should be in them, sinking between the Rocks, and running under ground; in so much as that in some places where they are overflowed in winter, they are forced in Summer to send their Cattle many miles for water. There is one place on a hill near *Tuam* between two of these *Turloughs*, where there is a hole the superstitious People call the *Divels Mill*; and make fables concerning it: if you stand by this place, you will hear a great noise, like that of a water under a bridge: where there is a flood in winter, one of the *Turloughs* overflows, and vents it self

self into the hole; and the noise doth, in all likelyhood, proceed from a subterraneous stream; which in Summer has room enough to vent all its water; but in winter, when rains fall, the passages between the Rocks cannot vent the water, and therefore it regurgitates; and covers the flats.



Let GH be a plain parallel to the horizon; let AAA be a hill; BNB a flat; CCC another hill; DND another flat; and EEE another hill: let LIM be a subterraneous rivulet, that runs under the surface of the Earth; at M let there be a narrow passage, which can only vent such a quantity of water; the head of the river above L is suppose higher then the flat BNB or DND ; the current suppose is swoln with rain, and brings more water to M , then can pass: it is plain the rest must fill the passage LI and at last burst out at NN , the holes suppose in the flats, and cover the flats; and by this means the whole Country in the winter seems full of Lakes; and again in Summer, when the passage M is big enough for the water of the rivulet, the water subsides and falls thro' the holes NN into the subterranean passages and in a little time leaves the flats dry till the next year.

These *Turloughs* are hard to drain; often they are encircled with hills, and then 'tis not to be expected: often they have a vent by which they send out a considerable stream; and then it is only making that passage as low, as the bottom of the flat, and that will prevent the over-

flowing : it sometimes happens that the flats are as low as the neighbouring rivulets, & in probability are filled; and then it is not only necessary to make the passage from the flat to the rivulet, but likewise to sink the rivulet which is very troublesome ; commonly the passage to be cut is Rocky : having never seen any of them cut, I can only say thus much;

1, Before they begin, a surveyor ought to take the level of the flat with the place into which the vent is to be made, and if the place be lower the vent is possible.

2, A good computation ought to be made, what the vent will cost? how much land it will drain? what the land is worth *per acre*, as it is? and what it will yield when drained? and by that he will see, whether it be worth the while to attempt it.

3, The holes *N* Nought to be opened, and digged, and fenced about, that grafs, and other dirt, may not get into them; for by this means the water will in its ordinary course, get sooner away; and lastly they are to be eaten very bare towards the end of Summer, that as little grafs as is possible may be spoilt by the water.

*An Abstract of a Letter from Dr Sam. Threapland of
Hallifax to Dr Plot of Oxford, giving an account
of Stones Voided by Sieg.*

A Carpenter, about forty years of age, of a strong habit of body, and very laborious in his calling, living about a mile hence, came to me about three weeks since, and made great complaint of the sad torture he had suffer'd by reason of two *Stones* he had voided by stool this last Christmas, there being about 14 days time between; the first was the less which is represented Numb. 12, Fig. 1. the latter is much larger, as in Numb. 12, Fig. 2, but both of them much diminisht, as to their various angles, and sharp points they had at their exit, by means of the fellows bearing them about with him in his pocket for four or five days, amongst his little Iron tools, that have relation to his trade. He perceived no alteration or disturbance in his body, till within 5 or 6 days that the first came away; then he began to complain very much of a pain in the belly, much resembling the *Colick*, and of a stoppage in the Intestins, not much unlike that in a *Tenesmus*, having frequent provocations to go to stool, but to no purpose upon tryall; he took little or no rest in all that time; his Stomack retained scarce any Meat or Drink it receiv'd; till in the conclusion one of the Stones came into the *Intestinum rectum*; where it lodg'd for a days time; then coming within the reach of his Finger, he drew it out by force, and presently after the dislodging of this troublesome guest, he was very well again; and so continued for a fortnight, till the other begun to move; which occasioned a pain beyond the former in proportion to its bulk; and kept him upon the rack about eight days; during which time, there was an absolute

suppression of excrements, and when the Stone came into the *Rectum*, it continued near two days within the reach of his Finger, with which he could not draw it out by any means; till at length he bent a small piece of Iron into the form of a hook, with which rude instrument his Servant drew it forth with much ado, and not without Wounding the rugous coat of that part.

After it was gone, he soon recovered his former condition and felt no further harm from this accident. About seven years before, the very like case had befallen him, Voyding two Stones after the same manner, and about equall bigness.

An Extract of a Letter from Mr. Anthony Leewenhoeck F. of the R. S. to a S. of the R. Society, Dated from Delf, January 5th. 1685.

Concerning the Salts of Wine and Vinegar, &c.

THough I have often excused my self, from examining the various figures of *Salts*, partly supposing it would be too much labour to me and more especially because in some *Attempts* of that nature, I formerly had no *Success*; The Warmness, or Coldness of the Air, causing great differences in the shapes of the *Salts*; nevertheless, by lighting on a new *Method*, I have been encouraged to make the following *Observations*.

Having found my yearly provision of *Vinegar* (which had layn about 3 Months in my *Cellar*,) to be more sour then ordinary, I left it open to the *Air*, during some hours, at which time I observ'd a very great many particles (which I call the *Salt* of the *Vinegar*,) as Numb. 1 Fig. *A.* tapering towards each end, and having in the middle a long brownish *Figure*: other of the same extent as *Fig. B.* being as clear as Chrystal; and these were the most numerous: others being long and brownish, which had in the middle of them, a bright clear substance, as *Fig. C.* In another place, were some few oval figures, within which were contained some lesser ovals, as *Fig. D.* Under the aforesaid *Figures. ABC*, I thought I saw many that had a Hollowness within them, like that of a *Boat*; sometimes one of the aforesaid figures, has appeared to me, with the one half brown, and the other part clear; sometimes one of the *figures* hath layn a thwart another, as at *E.* Sometimes there were *figures*, which seemed to have been cut in two, each of them representing but one half of *AB*, or *C*, as *F.* Many of these aforesaid *figures* were so small, as scarce to be seen, but

withall they were so numerous, that I judgd them, to be many thousands, in one small drop of *Vinegar*: besides an innumerable quantity of small *Globules*, six whereof would not equall a *Blood Globule*; and a much greater number of lesser *Globules*, 36 whereof would not rise to the bigness of a *Blood Globule*. In a word it seemed incomprehensible, that there should be so many particles contained, in so small a quantity of Moisture, and that transparent too. These aforesaid particles I take to be the *Sharp Pungent Matter*, which causes the sense in the Tongue, that we term *Sour*.

Altho' by a common Magnifying Glass I have seen the *figures* of this bigness, yet I suppose, these may be made out of a great many lesser ones, which may have the same *figure*: just as in *Sea-Water*, many Millions of *Cubical figures*, go to the making up one large corn of *Salt*, of the same shape.

I put into a Glass about two Inches wide a little *Vinegar*, which I let stand upon my Table for 8 Weeks. In this time, I found swimming upon the surface of the *Vinegar*, many particles, within which I perfectly discerned a hollowness like to that of the inside of a *Boat*; for the *figures* were now increased in thickness. Those that had the Cavity turned to the Ey, were as *Fig. G.* those whose sides were turned to the Ey, which had only part of the Cavity to be seen, were as *Fig. H.*

I have also described, a full grown live *Eel* (as *Fig. LM.*) such a one, whereof there were many more in the *Vinegar*. As also a full grown *Eel*, which I killed, that the designer might see it more distinctly, as *Fig. NO.* This also may serve to shew, the bigness of the *Salt* particles, compared with that of the *Eels*.

It is also to be noted, that the foregoing *figures* and *Eels*, are drawn by a common *Microscope*, and that there were many other smaller *Salt* particles, to have been discovered by my better Glasses.

Also

Also, I cannot but take notice, how some Men are deceived, that think the Sourness of *Vinegar*, proceeds from *Eels* pricking their Tongues, with their Tails; for if this were true, then would some *Vinegar* be flat, because there are no *Eels* in it, or that the *Eels* are dead in it, as is usuall in cold or frosty weather.

I considered some *Vinegar*, that had *Crabs-Eys* put in it; because they are said, to take away its sourness. If this be true, I concluded, that the above described *Salt* particles must be changed, either by increasing the bulk, or becoming more plyable and limber, so as not to pierce the Tongue.

I took severall new Glasses, and put in them some *Crabs-Eys*, split into small pieces, least the grit that comes from them, after they are pounded, should hinder my sight: I found that the long sharp *figures*, which might be likned to a Weavers Shuttle, were now changed into *figures*, whose *Basis* was oblong, rising up *Pyramidally*, like a pointed *Diamond*; as *Num 2 Fig. P.* Others had their *Basis* square as *Fig. Q.* Others an irregular *Quadrilateral*, as *Fig. R.* But these two last *figures*, I supposed were accidental, for want of sufficient matter to compleat, and perfect them on all sides. Note that the greatness of these *Salt* particles, and those in simple *Vinegar*, must not be compared together; because these are drawn by a *Glass*, that Magnified more, then that wherewith the others were drawn; for otherwise, these would not so clearly have been discerned.

The number of particles was so great, that (in a gross computation,) I judged them, to be six Thousand in a *Drop*, about the bigness of two *Barly-Corns*. But that which I most wondred at, was, that these *Salt* particles here, were almost all of the same bigness: (a thing I never observed, in any other *Salt* before.)

I took some *Vinegar* out of a *Glass*, that had *Crabs-Eys* in it, at a time, before all the *Air-Bubbles* were ascended:

cended : But even then the *Basis* of the *Salt* particles was four-square, and not as in common *Vinegar*.

When the *Air-Bubbles* were most of them ascended, I drank about a third part, of a thimble full of the *Vinegar*; and found it had no sourness at all in it, but rather a bitterness, and was so loathsome, that it made me ready to vomit.

I took also White Chalk, beaten to pieces, and put it in *Vinegar*, where it caused as great a commotion, and rising of *Air-Bubbles*, as the *Crabs-Eys* had done : It produced also, the same *figures* of the *Salt*, and the same insipidness.

From these observations, I am confirmed in an opinion, which I have been of a great while ; that when the sharp subtile particles of *Salt*, which are in severall liquors, come to be in the Stomack, they are there so coagulated, and compounded, that very few, or none of them, are communicated to the blood, or other parts of the body. For if the *Salts* of Wine, and *Vinegar*, did not change their *figure*, in the Stomack, I believe they would cause in the blood, and other Vessels, an intolerable pricking, if not endanger the life of the party. Besides, if it were not so, I should have met with them, some time or other, either in the Sweat, Blood, or Urine. Also the *Salt* particles, which are in Wine, or *Vinegar*, when the weather is moist, are curdled, or go together ; but afterwards, let the weather be what it will, I have never found them dissolved, or turned into water. And thus they are more durable then common *Salt*, which in moist, and cold weather, runs into a liquid form. Again, if the *Salts* in the Wine, or *Vinegar*, were not coagulated in the Stomack, the Urine, or Excrement of those that drink them, would smell of them : however, I will not say, that in all Stomacks, there is the like coagulation ; but if in some, the *Salts* are not altered, the drinking of Wine, to such men is very prejudicial. But
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it is otherwise with common *Salt*, for, if a small quantity of that be put in water, it will presently dissolve, and every Corn be divided into Millions of parts, being all of them four square; and if a great deal of *Salt*, be dissolved in water, and some of the water be evaporated, the *Salt* runs into great Corns. Now that it is true, that a grain of common *Salt*, is divided into square particles, a Thousand Millions of times less than a sand, and that each of these particles, is again divided into an incomprehensible number of other particles, before they will pass from the Bowells into the blood, and other parts of the Body, the assertion will not seem strange, if we consider, that in Insects found in common water, and our Excrements, which are not the bigness of $\frac{1}{1000000000}$ of a great sand, there is a Coat, or Skin, and perhaps Scales on it; that there are Feet, or Fins, wherewith it swims; a Mouth, Bowells, Veins, Muscles, Sinews; and all the inwards, as compleatly, as in the greatest Animal: and if the body of so small a Creature, may be imagined so divisible, much more may a particle of *Salt*.

When the blood has been some times out of the Veins, the small *Salts* then begin to go together, and appear, as I have often seen, and particularly, while I was lately busied about the CrySTALLIN humour of the Eye of a Man, I observed a number of small *Salt* particles, having the figures of common *Salt*; and I am perswaded, there is not a drop of blood in the body, which has not its share of them.

Having thus declared my opinion, upon the parts of *Salt*, I shall do the same, upon those of water. For as much as that a late Author, hath spoken of them, with such assurance, that ordinary Men coming to read him, imagine, the *Snakes* of which the water is made, to be very big: but if I should tell them, that those water *Snakes* are so little, that if a great sand were divided into a Thousand Million of parts, the *Snakes*

would be less then they, I believe this language would sound very harsh. For my own part, I cannot conceive the parts of water to be like *Snakes*; for I suppose, how little soever they are, they are always flexible; and by consequence put themselves into all *figures*, according as they are prest by the Air, or other bodys; and that when many water parts are together, each takes a different form, that it may apply it self to its neighbours, and keep, as much as possible, a round figure, as I have formerly said of the parts of fat. For example, let us imagine, that we have a great number of sheeps, or hogs bladders filld with water; these, as they are hung up in Air, will be all round, but as they are heapt up in a tun, and press one on another with their weight, yield, and accommodate themselves so, as to leave no empty space in the tun: thus every bladder hath its particular *figure*, tho' it most incline to be round; moreover, if the tun be rolld, every bladder upon the least motion, will alter its *figure*, as it is more or less prest. In the same manner I believe it is, with the Globules of Fat in our Bodys, and also with the particles of water; tho' these latter, I conceive to be so small, that if a sand were divided, into a Thousand Millions of parts, and if $\frac{1}{1000000000}$ of a sand particle, was again divided into a Thousand Millions, the water particle, would still maintain the roundish, and piyable *figure*.

I know this above mentioned opinion, that water is made, as it were of *Snakes*, is not new, but borrowed from the famous *Des. Cartes*. But (with respect to that Great Man,) every one is free to declare his Judgment, in things which have not been fully discovered,

I examined lately my Wine, which is very fine, and well tasted, such as in *France* is called *Vin de Damoisselle*, tho' it is but an *Orleans* Wine, brought down the *Loyre*; in it I saw many extraordinary pretty *figures*, of different sizes, and some very small, which I shall call,
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the *Salt* of the *Wine*: many of these *figures*, were of the same make, with those, of the *Salt* of *Vinegar* above-mentioned. I have in some of these *figures*, not only seen a Cavity, but found them encrease to so great a bigness, (by that time the *Wine* had stood 24 hours, uncovered upon my Table,) that they equalled the thick particles of *Salt*, which I had seen in *Vinegar*, as is here shewed *Numb. 3 Fig. A.* I saw also some *figures*, which had no sharp points, but were roundish at the ends, as *Fig. B.* There were also severall *figures*, which grew tapering at one end, and at the other were round, as *Fig. C.* Also some *figures*, which differed from *Fig. C.* In that one of their ends, was not round, but flat, as *Fig. D.* Also some few *figures*, were longish, representing a thin Right Angled Parallelogram, as *Fig. E.* Also there were many *figures*, whose two longest sides were roundish, and whose shortest sides were streight, resembling something a Barrell, as *Fig. F.* Some few *figures* made a perfect square; others again, were twice as long, as they were broad, being largest in the middle, and inclining towards the shortest sides; not much unlike a flat bottom'd Boat, whose fore, and after parts are flat, as *Fig. G.* While all these *figures* in great numbers, were driving together, in the quantity of a drop of *Wine*, twas a pleasure to me, to see so great Variety. These foresaid *Salts*, I conceive, would be sour upon the Tongue, if there were not a great many sweet particles, in this (as well as other,) *Wine*, mixt with them, which are not otherwise to be separated, then by setting the *Wine* to ferment; for thereby it presently looses of its Sweetness, and in time, is changed from a gratefull *Wine*, to a sour *Vinegar*. From hence I gather, that the pleasant Relish of *Wine*, consists, in its having not too many sweet, nor too many sharp parts, but one sort tempering the other, so as to make a Harmony upon the Tongue, and Palat. The same thing we experience dayly, by mixing severall things, which, if they were used simple,

would be either too sweet, or too flat, or too sour, whereof, I shall give but one Instance. Let us mix, or melt together Butter, and *Vinegar*; and it will prove a very gratefull sauce. As to *Sugar* (which is a *Salt*,) I have formerly said of it, the Sweetness herein consists, that the Angles, or sharp points, of which, the Powder *Sugar* is made, are easily separated from one another, and dissolved, when they are put in water, chiefly if it be hot; which happens to *Sugar* in the Mouth; for then it is not only Melted, and mixed with the Spittle, but becomes soft, and plyable, embracing any other body it finds on the Tongue, and communicating to it, its pleasantness. From these Positions, we may well comprehend, the severall Tasts that Wines are lyable to, tho' they grow in the same Vineyard; for not only, will the Bunches that grow, on the Southside of the Hill, be Sweeter, because the heat of the Sun, draws from them the superfluous moisture; but the sharp, or Salt parts in the Wine, by taking away the more waterish substance, become more rigid, and stiff. Also, we may imagine the reason, why Wine having stood some time in the open Air, looses its Savour: namely, that many small Salt particles are joined together, to make a few great ones; whereby, as the number of the Salts are lessened, the Sense is not so agreeably excited, as if it were toucht in more places, tho' the bodys that do it, are never so small.

I Observed some *Sherry Sack* (which proved to be as good this year, as ever was known,) and therein, discovered the *figures* of *Salts*, such as I have above mentioned in French Wine, Numb. 3. *Fig. A.* As also some longish *figures*, as *G.* But all these were but few, in comparison of the *figures* of *Vinegar*, and French Wine. Perhaps, if the *Sherry* had been thinner, the *Salts* would have appeared more; for there were many small particles, which I could not describe, because they were obscured by a thick matter, wherein they lay; but when I set some

Sack

Sack uncovered upon my Table, for three days and nights, I perceived in it, a great number of small particles, some whereof hung by one another, and lookt like the dry Branches, of a Tree: others moved confusedly in the Wine, so as I could not at first determine their shapes; but afterwards they seemd, to be like the *Salt* particles above described, having among them, many flat *figures*, with their sides turned up; their size was so small, that I judg'd a Thousand Millions, would not make up the quantity of a Sand. In contemplating some Gross flat particles, as also some sharp ones, which were imperfect, I was confirm'd in the make of those bodys, namely, that all the sharp *Salt* particles in the Wine, and *Vinegar*, how little soever they are, had at first flat thin bodys, which by being roll'd up at the four Corners, make the *Salts*, I have above described. As for example I see in the *Sack*, Numb. 4. *Fig. ABCD*, and *EFGH*. The sides of the one *figure* roundish and irregular, and of the other strait, (which I here draw greater then they appear, that their make may the better be seen,) the Corners *A* & *B* are bent or roll'd up as *Fig. IKL*, whereby the Corners *A* and *B* become a sharp Angle, as is to be seen at *I*. If the other two Corners *C* and *D* were also roll'd up in the same manner, we should see the perfect *figure* of a *Salt*. When the flat *figures* are but short, and only two Corners are rolled up, they appear as *Q*. or *R*. which are like the *figures C* and *D* in *Orleans Wine*. The appearance of *IKL* and *MNOP*, was as distinct, as if I had taken half a sheet of Paper, and roll'd it up at the four Corners, to make two sharp Angles, and leave the full breadth in the middle; I could also perfectly see a Hollownes within the figures, as much as can be represented in the Paper.

I set some *Mosel Wine*, for a few hours uncovered upon my Table, and then saw swimming in it, divers *figures* of *Salt*, such as I had formerly seen in Wine, *Vinegar*,

and *Sherry*; onely, there was this difference, that in many of them, I could not only perceive a thicknes, and a Hollownes, but also distinguish, that each of them consisted of 7, 8, 9, or 10, plates, lying upon one another. These I at first drew roughly, and afterwards got a good Artift to draw them again, from the Objects themselves, with a good Microscope, as here *Numb. 5. Fig. A.* I saw also, severall *figures*, out of the top of which, other half *figures* appeared, as *Fig. B.* There was something like this, in the *Orleans Wine*, but nothing neer so much as here. I saw also severall *Salts*, which had other particles thrust thro' them, as *Fig. C.* There were also some flat *figures*, whose sides were rolld up, as *Fig. D.* And some whose shortest sides were indented, as *Fig. E.* Some appeared like half of *A.* as *Fig. F.* A few others had their ends blunt, as *G.* But it was very strange, that I could see no small *figures* in the *Wine*, when it had been exposed to the Air 24 hours upon my Table; yet when it had stood a day longer, there were *figures* discernable, tho' so small, that I could not discover their fashion, because that the matter that encompassed them, was very thick.

I observed in *Hockamore Wine*, of a year old, (which was well tasted and generous,) after it had stood 3 hours uncovered, that there were *Salt* particles in it, which were sharp at both ends, having a height, or Ridge upon them, like the sharp bottom of a Boat, turned upside down, though they were otherwise Diaphanous, as *Numb. 6 Fig. A.* Such a kind of *figure*, has appeared to me in French *Wine*; But when I let this *Wine* stand for two days, and nights, some of the *Salt* figures were greater, having severall circumferences, some 2, 3, 4, and others so many, that they could not be counted, as they lay close together; some were so beautifull that no Sea Production, whether Corall, or shells, might be compared to them, As in *Fig. B.* Among these *figures*, some were so transparent,

rent that their Circumferences were not to be seen, but some few seemed to be compounded, of small *figures* of the same shape. I saw some that were blunt at both ends, yet one would be blunter, then another, and some times one end, more then another : as *Fig. C.* In another place, I saw, swimming in the Wine, *Salts*, which had not only severall circumferences, but steps, or wrinkles across, as at *D.* Moreover, I saw some little particles of different sizes, which had the aforesaid circumferences, but many of them exactly represented a Wine Vessel, as some of a *Foeder*, or *Rhenish* Wine Vessel ; others a long Tun ; in observing some places, where the thinner part of the Wine, was evaporated away, I found severall *figures* like Branches, or Boughs, seeming to proceed from one *Salt* particle ; in viewing them exactly, I saw that the Branches consisted of nothing but very small *Salts*, joined together, some whereof were very regular, and the greatest were placed at the end of the Branches, as at *F G H I.*

In the beginning of December last, I observ'd the *Hockamor* Wine, which grew in the year 1678, and found at first, very few *Salt* particles ; But when I had let the Wine stand 3 or 4 days, there were many more, tho' in much lesser numbers, then in the same Wine, that was but of a year old. But I am perswaded, that the largest of these, consisted each, of above a hundred small ones, compacted together, as *N. 7. Fig. A.* When the greatest *Salts*, were got together, the smaller particles swimming in the Wine, cleaved to them, for there were none of them, to be seen about the great ones, though I sought for them, twelve severall times. Now and then, there was a *figure*, that seemed the half of the aforementioned, as *B.* and thereby, some small *figures* which were Diaphanous, and whose points, were not proportionably sharp, as the great ones, as *Fig. C.* There were also some Diaphanous particles, greater then the last mentioned
having

having a small *figure* in the Middle, as *D*. There were also, a few that were blunt at the ends, as *E*. There were also some resembling dried Branches of a Tree, (as was mentioned in Wine of a year old,) which branch like *figures* consisted of small *Salts*, hanging together.

From these Observations, I guess what may be the cause, that *Rhenish* Wine, not only keeps good a great many years, in a well stopp'd Vessel, but also looses its fourish tast, and takes one that is sweeter, and milder; namely, for that the *Salt* particles in the *Rhenish* Wine, cleave together, and then stick to the bottom, and sides of the Fat, (being called by us Tartar,) and by how much older the *Rhenish* Wine is, by so much are the *Salts* fewer. But the nature of French Wines is contrary, (as I have Observed,) for the *Salts* in a well stopp'd Vessel, do not run together (Chiefly in *Bordeaux*) Wines, and therefore they never get a Milder, or Sweeter tast: But in Wines that come from *Nants*, tho' the *Salts* run more together, nevertheless the Sweetness is presently lost.

I bought some Wine for *Rinco*, very pleasant, and of the growth of 1683. But it proved to be of the Palatinate. At first I observed few *Salts* in it, but when it had stood open 24 hours, I discovered many, that were sharp at each end, as *N. 8. Fig. A.* having a division running along them, but being otherwise Diaphanous, and appearing by the Microscope, of the same bigness here drawn; but there were an innumerable quantity of a lesser sort, which were of the same *figure*. I also perceiv'd some, that resembled a Wine Vessel, but they proved to have two sides rolled up, (as *Fig. B.* (and perhaps, others of the same *figure*, which I have before mentioned, may be roll'd up like them, in regard I then might have seen them onely, by the plain side.) Likewise may the *Salt figures*, which I have described as blunt, at one or both ends, be like *C.* and *D.* I saw also *figures* as *A.* which had both their sharp points rolled up together, as at *C.* Also *figures*

figures whose one end, was not roll'd, as at *D*. Some few *figures* there were, whose Basis was square, having the sides rising up Pyramidal like a pointed Diamond, as *E*. But of these, there were not above one, or two, in a Drop of Wine. Sometimes one of these *figures*, would be plac'd in the middle of another, as at *E*. (which remarks in some other Wines, I have thought scarce deserv'd to be mentioned.) Some *Salt figures*, had their sides roll'd up, so as the ends did not touch one another; but left an opening in the middle, as at *F*. Whereas others, that were more shut, seem'd only to have a line upon the back of them. Sometimes there appeared *figures* long, and slender, as *G*. as to these last, I am in doubt whether they are compleat, or only a beginning of a *figure*, there being some stuff wanting, to perfect them: for there were few swimming in the Wine, but most of them lay in places that were almost dry. But above all, the number of a sort of small soft particles, was the greatest, to which, I can allot no other *figure*, then Globular, the whole body of the Wine (except the *Salt* particles,) seeming to consist of them, and the Sweetness to take thence its rise.

I took a little *Rinco* Wine, which had workt in the Fat, all the foregoing Summer, and had been pierced some weeks since, when it was fine, and had a good tast; this Wine, when it had stood upon my Table, about an hours time, had many *Salt* particles in it; but after it had stood sixteen hours, the *Salts* were thick, and had such a deep Boat-like *figure*, as I have formerly mention'd in *Vinegar*; and may be here seen *N. 9. Fig. A*. There were also severall *Salts*, that had other brown longish *figures* in the middle of them; and some that had two, three, and four circumferences, as *Fig. B*. Some particles had a line, or joynt running thro' them. Others were altogether Diaphanous, as *Fig. C*. Others had one sharp end, and the other blunt, by reason that they were

not yet perfect; as I have above mentioned. And some again were very Diaphanous as may be seen under the Letter *D*. Some *figures* appeared as *E*. and when I lookt upon the places, where the Wine lay thin, and was almost evaporated, I saw a great number of particles, the most of which, had two sharp ends, and were a Thousand Millions of times smaller, then a great Sand. I saw also particles of *Salt*, swimming about, which had the true shape of a Wine Vessel, but they were very thin and clear; and I could not perceive any line or joynt, going through them. There were also severall Oblong particles, very thin and clear, and therewithall very small; tho' they be drawn great, as at *Fig. H*. Because I was forced to use to *F* and *H*, a lesser Microscope then to the other six Letters *A B C D E* and *G*. Also when the Wine had layn thin, there were severall Branch-like *figures*, consisting of irregular *Salts*, the shape of many whereof, could not well be exprest.

I examined *Cequence* Wine, and found the *Salts* to be mostly, as *N. 10. Fig. A*. Some of which were, as it were, rolld up; others were thin and pellucid; and others when the Wine had stood long, were so thick, that they had a brown circumference about them, as *Fig. B*. Severall were like the half of *A* and *B*, as *Fig. C*.

I examined also *Coteau* Wine, and found severall particles, as *A B C, N. 10*. And moreover, severall whose sides were rolled up, as *Fig. D*. Also flat *figures*, whose longest sides were strait, and both the ends Circular, as *Fig. E*. Also *Salts* having a sharp point, as *Fig. F*. Also particles representing a flat bottom'd Boat, turnd up side down, as *Fig. G*. Other of the same make I could look into, as into a Cavity. There were also, severall very small and long particles, as *Fig. H*. which I imagine, if they had more stuff, would have been as *E*. There were likewise some *Salts*, as *Fig. I*.

I also observed *Tonjain* Wine, which was very thick
and

and Sweet; (tho' many in this place do think, that the Sweetness, which this Wine has had, for 4 years past, is not naturall, but procured by Brim-Stone, high Country Wine, or Syrups,) I found the *Salts* to be the same, as those in *Coteau* Wine, but not so many in number as they; this only difference there was between them, that in the *Tonsain* Wine, severall *figures* had as it were stairs or partitions in them, as *Fig. 10. Letter K*,

I took *Tonsain* Wine, which was said to be pure, and unmixt; and discovered in it, all the *Salts* mentioned in *Coteau* and *Tonsain* Wine, but I judged that the number of the *Salts*, in this fermenting *Tonsain* Wine was 25 times more, then in the Sweet *Tonsain* Wine, but not so big as they. Also the *Salts* in this last Wine, after a few hours swam about, but in the Sweet Wines, the *Salts* were a great while before they appeared.

I found likewise in *Citeruse* Wine, all the severall *Salts* which were in *Tonsain*, and *Coteau* Wine, in great Quantity.

I took *High Country* Wine, of the deepest sort, and found swimming in it, very few *Salt figures*, tho' I let it stand 3 days and nights; but the *Salts* were much bigger, then in the *Coteau* and fine *Tonsain* Wine; and had the shape of *ABD*, and *G*, in *N. 10.*

I took *Rhenish Wine Tartar*, beaten very small, and put it in fair Rain-Water, and when the water was settled, I saw in it, many such *figures*, as I have mentioned to be in the Wine, viz. some which were very clear, and had two sharp ends, as *N. 10. Fig. L.* But the most of them, were very irregular, the cause whereof may be, that there was no sweet, or Oily stuff mixed with them.

I took the *Tartar* of *French Wine*, and examining it in the same manner, as the former, I found some *Salts*, which agreed perfectly with those in the Wine; but the rest of them were more irregular, then in the *Tartar* of *Rhenish* Wine.

I took *Orleance Wine*, pure as it came out of the Vessel, and put into every drop, (as neer as I could guess,) a piece of *Crabs-Ey*, as broad as the knife, and when it had stood 3 hours, I could find no such *Salt* in it, as I had seen in the Wine, that had no *Crabs-Eys*. But there were very many *Salts*, whose basis were an oblong square, and the sides rose up Pyramidall. Other *Salts* were flat, as *N. 11. Fig. A*. Others were six sided, as *Fig. B*. Others had two slanting sides, as *Fig. C*. Some few Quadrilateralls had four sided *figures* within them, as *D*. Others of them, had the shortest sides something irregular. Some *Salts* were as *Fig. E*. In these last I could perceive no rising, perhaps because they were very little. As I viewed a piece of *Crabs-Eys*, I saw rising as it were from a point, in about fifty places, severall thin Pipes, as cleer as Christall, one whereof was longer then another, but they were all generally of the same thickness.

I likewise took Wine, and put white Chalk into it, in the same quantity as before, letting it stand about a quarter of an hour, before I observed it, and then I found a great number of the afore mentioned *Salts*; but they were not so big, as those in the Wine mixed with *Crabs-Eys*; but when this Wine and Chalk, had stood about 12, or 14 houres, I saw the *Salts* above mentioned, not only greater, but the Pipes likewise in severall places, rose from a point of Chalk, in great quantities, as above in *N. 11. Fig. F*. These Pipes also, were bigger then the others, tho' they differed sometimes in bigness, among themselves. The Wine that had *Crabs-Eys* in it, had a kind of a Skin upon it, (which I judgd to proceed from its sweet particles,) but the Wine that had Chalk in it, had none, and remained very thin.

I put into *Rinco Wine*, some pieces of *Crabs-Eys* and after 12, or 15. Minutes, discovered a few *Salts* in it; but when the Wine had rested some hours, I found in it a very great number of *figures*, as *N. 11. A B C D E and F*.

F. the *Salt figures* first discovered, were now grown big, tho' none of them were like the *Salts* in *Rinco* Wine, which had no *Crabs-Eys* in it.

Since we now see, by all the foregoing Observations, that *Rhenish*, and *French* Wine, contain no *Salts*, which agree in *figure*, with the *Salts* in the Chalk, which is taken from Men that have the Gout; we may now confidently say, that the *Salt* of Wine does not cause the Gout; and hereof we have a dayly experience, for some persons, that drink great quantities of *Rhenish*, and *French* Wine, have never had any touch of the Gout; and others that drink no wine at all, are very much troubled with it.

From this Cleaving together of the *Salts* in Wine, and the alteration of their *figures*, we may ascertain our selves, that in a well constituted body, the *Salts* of Wine do not pass into the blood; chiefly, if we take it for granted, that the use of the Stomack, and Bowells, is 1. to break in pieces the Meat, 2, to make the grosser particles come together. 3, to send the thinnest stuff, and smallest particles of the Meat into the body, for its nourishment.

P.S. Since the writing this Letter, I have opened a *Bitch*, and found in the Womb, or rather in both the Tubes, a great quantity of the Male Seed of a Dog: concerning which I shall enlarge in my next.

*Description dela Lovisiane nouvellement decouverte
au sud Ouest dela Nouvelle France ; par Lovis
Hennepin Missionnaire Recollet, &c. A Paris
1683. 8o.*

THE Voyage which is here described, was begun under the conduct of Monsieur *de la Salle*, at the latter end of the year, 1678, from the Fort of *Frontenac*, in about 45 degrees North Latitude, being the most Westerly Plantation of the French, in the River of *St. Lawrence*. It was continued (behind most of the Territory's of the King of *England*, upon the Continent of *America*,) first thro' the Lake of *Frontenac*, or *Ontorio*, being 80 Leagues long, and 25 or 30 Leagues broad ; next thro' the Lake of *Conty*, or *Erie* ; then thro' the Lake of *Orteney*, or *des Hurons* ; lastly thro' the Lake *Dauphin*, or *Illinois*. These 3 last Lakes are neer of an equall compass, being about 120, or 130 Leagues long, and 40, or 50 Leagues broad. At the further end of the Lake *Dauphin* in about 37°. of Latitude, the Voyagers went up a River South, till they came to a certain *Passé*, of about a League and a $\frac{1}{2}$ over land, leading to the River *Illinois*, or *Segnelay*, which, after about 200 Leagues, falls into the River *Mechacipy*, or *Colbert* ; and that, after about 120, or 130, Leagues more, runs into the Bay of *Mexico*. These last 130 Leagues are taken from the Relations of others, and were not travelled by our Author ; but instead of that, he makes you amends with 500 Leagues rowed up the River *Mechacipy*, in a Canot, or Brark, against the Stream. What Authority there is for these last Numbers, I cant well see ; for if the length of the way be incredible, you are like to find no Circumstances to help you to correct them : whether the design of the Author were to take Possession of a great Continent ; or only to
convert

the Country, when he understands the Languages, is not plain; for he ought rather to have gon down the River *Colbert*, if he only sought a more commodious passage for Skins into Europe, then that thro' the Bay of *Canada*, which is very dangerous, being in some places too rapid, in others having falls or cataracts, the most considerable of which called the *Sault de Niagara* is neer 500 foot perpendicular.

The mouth of the River *Seignelay*, is in about 36° . and $\frac{1}{2}$ of Latitude; the River *Colbert* there about, is a League broad, and in some places two.

The Country's *Illinois*, and *Luisiane*, are described to have large Meadows; plenty of Trees for building of ships; Vines, and Hemp, growing naturally; and also to yield Plums, Cherry's, Citrons, Apples, Pears, VValnuts, small nuts, Gooseberry's, Indian, and other wheat, Turneps, Melons, Pumpkins, Cabbage, and variety of Pulse; to abound in Indian Cows, Dear, Goats, Bevers, Otters, Porcupines, Tortoises, and (among Beasts of Prey,) in VVolves, Bears, and wild Cats.

To have severall sorts of Fowls, as Swans, Turkey's, Bustards, Herons, Crows, Ducks, Partridges, wild Pidgeons, Parrots, &c.

For Fish, to have Sturgeons, Salmons, Salmon Trouts, Pikes, Carps, Eels, Turbots, and severall other kinds, not known in our parts.

There are also Mines of Coal, Slate, and Iron, small pieces of pure Copper, a fountain of Salt, and Allum, and doubtless other things not discoverable by so slight a survey.

*An Essay of the great effects of even Languid and Un-
heeded Motions. London 1685.*

THE Author of this Essay tells us himself, that it was designed to facilitate the explicating of the Doctrine of occult qualities; and premises this postulat-um in order to the demonstrations that follow, *viz.* that we are not to consider bodys as so many lumps of matter that differ only in bulk, and shape; but rather as bodys of peculiar internal textures, on account of which they must be considered as Engines, whose operations being furthered by the mechanism of the body wrought on, and the relation other bodys have to it, a great part of the effect is due to the action of one part of the body it self that is wrought on, upon another, assisted by the concurrence of the Neighbouring bodys. Hence he takes notice of the chief causes upon whose account men are wont to over-look or under value, the efficacy of local Motions which are either unheeded, or thought languid. The first thing overlooked is the efficacy of the celerity of small bodys moving through a small space; how great this is he illustrates by considering the powerfull effects of Bullets; the great incallescence caused by the brisk Motion in turning of Metals, as Steel and Brass, the fragments of which are often so heated, as not onely to offend the Ey-lids; but even to blister the hands of the workmen: vitrification it self being produced by the common striking fire between a Flint and Steel. Neither are fluid bodys incapable of making impressions on solid ones, witness Sunbeams in the focus of a Burning-Glass; the Flame of a lamp; and even the Air in a good Wind-Gun. Though we are in the second place too apt to think, the softness of fluid bodys, and their insensible Motion may hinder them from those effects. But to
shew

shew the contrary, besides the obvious instances of deluges, and storms, he produces many of the strong operations of Sound upon distant, and solid bodys. One of the most remarkable of which is the effect of an Instrument though small, by which an Engineer could sink Ships in a few Minutes; the Explosion being so great as to cause a kind of Storm in the water round about, and rudely shake Vessels that lay at no inconsiderable distance. He observes again that men undervalue the motions of bodys too small to be sensible, though the numerosness enables them to act in swarms: yet how little reason they have for it, he evinces by the operation of the wind in autumn; the dissolution of Sugar in that water; where Amber, though lighter, sinks and remains entire by the activity of the Flame of Spirit of Wine; that of the Animal Spirits in large and bulky Animals; the forcible motions produced by glaciation in liquors, &c. to which effects of local motion its propagable nature, even through differing medium's, and solid bodys does not a little conduce. For though it be true that fluid bodys do easily yield to solid ones that impel them, and thereby oftentimes quickly dead the motion of those solids: yet the motion being lost only in regard of the solid body, is transmitted and diffused in reference to the fluid.

The modification of the invisible motion of fluids, as to what they may perform on the disposed bodys of Animals is as little regarded; though it is not so despicable if we believe Scäliger's Story of the sound of the bagpipe being too diuretical upon a Knight of Gascony; several sorts of noises set the Teeth on edge, and a domestick of the Authors allways bled at his Gums, when he heard brown Paper tore: add to this the cure of the Tarantula, and two verses of *Lucan* which seldom fail to put the Author almost into the fit of an Ague, &c.

Neither is efficacy confined to organical bodys but ex-

tends also to inorganic ones; as is evident from the Sympathy of strings; ringing of a Glass to such a note; as likewise some Ecchoes answering only certain sounds; and the like. The mistake likewise is as great when men look upon divers bodys to have their parts in a state of absolute rest, when as they are in a state of tension, or compression. Instances of this are the sudden cracking of Glasses that seem to be well seal'd; the scaling of well heated Copper; the brittleness of mixtures of metall; all which and the like probably proceed from contraction. The last main cause why such motions are overlooked, is our being used to the sensible motions of solid bodys when as many effects proceed from the intestine motions produced in and among the parts of the same body. Such as tools being overheated and by being so, losing their temper; the breaking of optick glasses in grinding; bodys becoming electrical, and odorous by rubbing; and the like; from all which he concludes, that such local motions as are wont to be pass by unobserved, may have a notable operation upon such bodys as are peculiarly disposed to admit it, and so have a large share in natural productions.

In the discourse of some unheeded causes of the salubrity and insalubrity of the Air, he confines himself to the imprægnation it receives from subterranean effluvia. Of these he makes two sorts, some constantly are sent up into the Air, which he calls ordinary Emissions; others ascend only at times, these are extraordinary emissions; these again are periodical or fortuitous. This doctrine he endeavours to illustrate by asserting, first, that in divers places the salubrity or insalubrity of the Air considered in the general, may in good part be due to subterranean expirations, especially to those he before called ordinary emissions for this he appeals to experience, which finds some places more healthy than the manifest qualities would permit one to expect; this effect he therefore ascribes

ascribes to the friendly effluvia from the earth, and argues from the observations in Hungary, and Bohemia, where the Air is impregnated with mineral exhalations, suitable to the Oar the Earth contains under it. He affirms it also probable that in divers places some Endemical diseases do at least in part depend upon subterranean Steams especially where the cause of the distemper cannot otherwise be accounted for, if together with this we consider the perviousness of human bodys, & the penetrating quality of mineral expirations, of which he gives many experiments. Lastly, he discourses of pestilential Feavers, and of the Plague it self, as to whose being natural or supernatural, he assents rather to its being the former; his entire judgment about which consists of two parts, one, that it is exceeding difficult to assign the true and adequate cause of the origine of the pestilence; and the other that what ever be the cause of its first eruption, its propagation, and divers of its Symptomes may be probably enough referred to the depravation of the Air by subterranean Steams, and their effects, &c. He describes the *Emplastrum attractivum Pestilientiale*, together with the *Magnes Arsenicalis* a chief ingredient of it; and discovers his opinion and experience of the great efficacy of Goats-rue in Malignant distempers, but when Medicine fails, those diseases generally appearing under new shapes, he accounts for the sudden ceasing of the contagion, among other ways, by the ascension of fumes of a contrary nature, which though perhaps in themselves unwholesome, may nevertheless combine with the pestilential ones, into a third kind, altogether innocent.

Trichiasis admodum rara, &c. Lond. 1684.

THIS *Trichiasis* or *Flux of Hair* continued for some years, both at a *Fistula* in the *Abdomen*; and likewise by the *Anus*; the manner in short thus. This Woman having been gone some months with her second Child, came to *Diep*, where carelessly going on board a Vessel, she hurt her belly against a Plank; this bruise was followed by a humor which ended in a *Fistula*; whence issued great quantity of *Hair*, attended with much purulent matter, till at length the *Viscera* were corrupted, & the *Faces* came that way too, so that she died. Anatomy easily discovered the wonder of her sickness; the contiguous *Viscera* were sphacelated; the right appendix of the Womb not distinguishable into its known parts, but consisting of one long tumor, covered with a thick skin; which was opened; in it was found an oval bony substance, hairy on the upper part, hollow & rough on the lower; one end of which had some lines of a face; the other seem'd designed for the insertion of the *Vertebra* of the neck. That this body was the source of that succession of *Hair*, is plain from their be-its agreeing with that on the bone; and likewise from the experiment of the Authors, who tells us; the *Hair* continued still to grow, though the bone had been kept a long time in Spirit of Wine. This conception was in the *Tuba*, for the Womb it self was found intire. The sagacity of Dr *Ferd. Mendez* affirmed this to be the case, while the Woman was alive, and his Epistle to the Author annexed to this tract, accounts for the *Phænomena* of the distemper, both by reason and examples. Mr *la Vasseur* has likewise an Epistle to the same purpose, in which he very satisfactorily discourses of three things. First, how it came to passe that a part of an *Embryo*, dead some years before, remained uncorrupted? Secondly, how the Womb it self escap'd; and lastly, how that long crop of *Hair* should proceed from so small an original.

*Printed at the Theater at Oxford for Sam. Smith at the
Princes Arms in Pauls Church-yard London; and Hen.
Clements Book-seller in Oxford,*

Fig: 2.



Fig: 3.



Fig: 4.



PHILOSOPHICAL TRANSACTIONS.

May 20th. 1685.

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*An Account of a sort of Sugar made of the Juice of the
Maple, in Canada.*

THE Savages of *Canada*, in the time that the Sap rises, in the *Maple*, make an Incision in the Tree, by which it runs out; and after they have evaporated 8 pounds of the liquor, there remains one pound as Sweet, and as much *Sugar*, as that which is got out of the Canes; Part of the same Sugar, is sent to be refined at *Roven*.

The Savages have practiced this Art, longer then any now living among them, can remember.

There is made with this *Sugar*, a very good Syrup of Maiden Hair, and other Capillary Plants, which is used in *France*.

An Extraēt of the Journal of the Society at Dublin; giving an account of a Periodicall Evacuation of Blood at the end of one of the Fingers.

Decem. 22, 1684.

A Letter was read from Mr. *Ash*, in answer to a *Query* sent down by the *Society* to him concerning a man who had a constant and periodical, *Evacuation* of *Blood* at the end of his fore-Finger; from which Letter the following return is abstracted.

Walter Walsh, an Inn-keeper in *Trym*, born in *Ireland*, of a temperate Diet, Sanguin Complexion, and pleasant Humor, in the 43d year of his Age, anno 1658, about Easter, was seiz'd with a great pain over all his right Arm; a great heat, and redness in his right hand; and a pricking in the point of the fore-Finger; whereon there appear'd a small speck, as if a little Thorn had run in; and supposing it such he open'd it, whereupon the *Blood* spun out in a Violent but small stream; after it had spent its Violence, it would cease for a while and only drop, and then spring out with Violence again, continuing thus for 24 hours, till at last he fainted away, and then the *Blood* stancht of it self, and his pains left him: from that time during his whole life, (which continued 12 years,) he was frequently troubled with like *Fits*; seldom having a respite of 2 months, and they never returned oftener then in 3 weeks: he rarely *Bled* less then a Pottle at a time; the oftener the *Fit* camē the less he *Bled*; and the more rarely it assaulted him, he *Bled* the more; whenever they endeavor'd to stanch the *Blood*, it rais'd most exquisite tortures in his Arm; no remedies

that were ever used proved in the least effectually: he had no other distemper that troubled him; neither season, nor weather wrought upon him: he had no outward accident that at first brought the *Bleeding*: Drinking more then ordinary made him more apt to *Bleed*: he had no Child after his first seizure: these frequent *Fits* brought him at last very low, insomuch that towards his latter end he *Bled* but little, and that too but like diluted water. He dyed of this Distemper on the 13th of Feb. 16⁶²/₇₃.

A Discourse concerning Weather, &c. By the learned Dr Garden of Aberdene. Written by way of Letter, to Mr. Henry Scougall, Professor of Theology in that University; and communicated to the Phil. Soc. of Oxford, by the reverend Dr Middleton, Provost of the Kings College in Aberdeen.

Sir.

I Am sorrie, I can give you no better satisfaction in this account you demand of the Conjecture we had lately occasion to talk about, my other necessarie diversions and the few observations I have made, render it the more imperfect. However since 'tis your pleasure, you shall have it as it is; and if it come afterwards to be cleared & confirmed by the joynt observations and sentiments of others, it may pass for an Aero-Statical Hypothesis of the various changes of the Weather.

We have been hitherto to seek for an intelligible account of the ascent of Vapours, the ballancing of the Clouds and their dropping down again into rain; and the wind bloweth where it listeth, and we know not whence it cometh, nor whither it goeth; and 'tis like our conjectures about the more immediate causes of all these may be still uncertain GuesSES, yet the works of God are fought out of all those that take pleasure in them: and the late known properties of the Air, viz. its weight and Spring have made men more inquisitive in this matter then formerly: and you know how by the observations of the Baroscope they perceive that the Atmospheres Gravity is not always the same, and are surpriz'd to see the Mercury subside for the most part in Foggy, rainy, windy, or cloudy, weather; and on the contrary to ascend and be highest in calm and clear seasons. I shall not stay here to tell you the Conjectures of others about this, but shall only take occasion to consider how this may

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serve

serve to put us in the right rode in our enquiries about the Variations of the weather.

And first the Air being a fluid, we are to take notice of those properties which it has in common with other fluids, and those wherein it differs from them, in so far as they concern this matter. It agrees with all other fluids in this that it Gravitates; and again it has this peculiar property (which is not so much observ'd of other fluids,) that its *specific Gravity* is not always the same. Now you know according to the certain rules of the ballancing of fluids amongst themselves, every fluid specifically lighter then another will ascend and emerge above it, and every fluid specifically heavier will descend and subside below. Thus if a Glasse in whose bottom there is oyl be fill'd with water, the oyl will emerge above, but if the water be drawn out with a Siphon, and the Air (a specifically lighter fluid,) succeed, the oyl will subside again. Now there is some certain proportion between the specific Gravities of the fluid of Air, and of that which ascends in Vapours and falls down again into rain; and if this proportion were still the same, 'tis like we would have no commixture of those fluids, but the Vapours would either always float above or always stay below. But this proportion of their specific gravity is frequently changed; for it is known that water when warm and tepid is lighter then when it is cold (and yet perhaps too the small particles of it (if figured according to *des Cartes* his conjectue,) are more capable of ascending in Vapours in frost then at another season, as being more extended, and so having a larger portion of the fluid of Air to bear them up;) and the daily observations of the different heights of the Mercury in the Baroscope do make appear that the Atmospheres gravity is not always the same. And now from these known properties may be easily deduced a statical account of the rising of Vapours, their being carried in the Air in Clouds and their falling down again into rain.

For

For if we may be allowed to suppose that when the Atmosphere is heaviest, there is some such proportion between its specific gravity, and that of the fluid of Vapours, as there is between water and oyl; the Vapours according to the known laws of fluids must needs ascend, and so long as this proportion continues they must needs float above in the Air: but when the Atmospheres gravity is chang'd, the Vapours must fall down again. Thus you see how easily this may be accounted for, and how reasonable this supposition is from the known properties of these fluids.

Now let us see whether this accords with observation and experience. And first as to the ascent of Vapours, I do not know any determinate Instrument that will Indicate their ascent as certainly as the Baroscope does the change of the Air's weight (for our common Hygroscopes are not very exact, and besides I suppose their change by moisture shews rather the falling then the rising of Vapours) yet there are two or three observations which seem certain Indications of their ascent: as first, if the Horizon and the remote Hills seem Smoakie and inconspicuous, so that nothing can be seen at any distance, and that tho' the Heavens be not cloudy, but clear, and tho' there be no Fog nor yet any Cap of Clouds upon the Hills (which do rather indicate the falling of Vapours,) again if when you look to any distant part of the Country round about you, it appear all in an undulating motion (and this you know our Countrie People call by the name of Summer Colts in the Air,) this seems to be a sign of the plentiful rising of Vapours, for this is only occasioned by looking through an unequall waving Medium, which makes frequent inflections of the beams of light, as you see any object seems to have a tremulating motion in all its parts when you look upon it through Smoak. Another Indication of the ascent of Vapours seems to be the copious rising of Steams above waters, marish grounds and fens,

which is frequently seen in frosts and in cool nights in Summer. To these I may add the redness of the Sun (so as to be easily look'd upon, and moon, a considerable time before their setting or after their rising. Now since I have had occasion to make observations of the Baroscope, I have always taken notice of all these, when the Mercury was rising and consequently in the increase of the Atmosphere's gravity; I have then frequently observed how inconspicuous and as it were Smokie the Horizon & remote Hills would appear tho' there were no Clouds in the Air, and in what a tremulous motion remote objects seem'd to be, and how copiously the Steams did arise from waters and marishes, and how red and easie to be looked on the Sun was for a considerable time before setting. But on the contrary when the Mercury has been low in the Baroscope and so the Atmosphere's gravity less, I have observed none of these effects, but the remote Hills were clear and distinct (unless some times a Cloud had falln down upon them,) and no waving to be observed in the Air nor Steams from the waters. I know not whether I may add here a conjecture about the great light & the *Capræ saltantes* which are some nights to be seen in the North. I have taken notice of them usually when the Mercury has been high in the Baroscope; and then they appearing in that quarter of the Heavens where the Sun is at that time below the Horizon, this has given me occasion to think that perhaps the Steams of Vapours may have ascended so far in the Atmosphere as to be beyond the Earth's shadow in that part of the Horizon, and so by refracting the beams of light towards us to occasion that light and those *Capræ saltantes*. It may be considered also whether the red skies in the Evening which betoken fair weather, do not proceed from the height of the Clouds occasioned at that time by the increase of the specifical gravity of the Atmosphere.

Now as to the falling down of the Vapours again, it is
visible

visible by their gathering into thick and dark Clouds, by the falling down of Clouds and Mists on the tops of Hills, and thick fogs in the Air, and by their dropping down into rain, snow, &c. and that these do usually fall out only when the Mercury subsides a little, and consequently when the Atmosphere's gravity is less, is the constant observation of those who have had occasion to take notice of the changes of the Baroscope. And thus you see how this Hypothesis for the ascent of Vapours and falling down of rain, grounded on the changes of the Atmosphere's gravity answers daily observation & experience.

Against this it may be objected, that it is observable many times that even when the Mercury in the Baroscope is rising there will be rain, and particularly sometimes in North East Winds. To this I answer that the Vapours will fall down into rain not only when the specific gravity of the atmosphere is lessened, but also if the Clouds have been carried for some while towards one quarter of the Heavens by the Winds, & then if the Winds do suddenly change into another quarter these Vapours, which were formerly scattered into small particles and so did easily float, are suddenly driven together into little drops and so must needs fall down into rain, and therefore the falling of rain while the Mercury is rising is observable only upon the sudden change of contrary Winds.

But let us consider in the next place whether those frequent commotions in the Air which we call Winds, may not be accounted for upon the same Principles, and this we shall do as formerly by looking into the nature of a fluid in the general and of the Air in particular, as to fluids in general, that known definition of Archimedes is universally acknowledged, *Quod earum partium minus pressæ expellantur a magis pressis*, so that if there be any portion of a fluid of a far less pressure and resistance than the rest, the whole fluid runs in a current thither, till all be reduc'd to an *Æquilibrium*. This principle is so uni-

versally received and known that we need not stay to make it good. Now as to the fluid of Air in particular, it is evident, as has been already made appear that 'its pressure is not always the same. And 'tis very probable (which Experience will determine by making joynt observations of the Baroscope in severall places of the Earth at the same time,) that the Air's gravity is not alike chang'd throughout the whole Atmosphere in an Instant; but that the Mercury may have subsided in the Baroscope, and consequently the Air become lighter, at *London*, for example, when there is no such change observ'd at *Paris* or *Edinburg*. Now this supposition doth give us an intelligible account of Winds from the known nature of fluids. For when the Air becomes specifically lighter in one place, or its pressure lessened, the Neighbouring parts of the Atmosphere whose weight is not thus lessened, run thither in a Current till the Atmosphere thereabouts be reduc'd to an *Æquilibrium* again; and according to the portion of Air thus chang'd and the lessened or acquired degrees of the weight and spring, the currents and Winds are strong or weak, of a long or short continuance.

Now Observation and Experience do agree with this, the Mercury being found to subside for the most part in the Baroscope at the rising of Winds; at least it is observ'd to be in motion, and either rising or falling, or consequently there is a change in the Atmospher's pressure at that time. And thus we have an Intelligible and Aero-Statical account, of the ascent of Vapours, of their falling down again into rain, and of the currents and Impetuosity of Winds, from this known property, the Variation of the Atmosphere's gravity.

But I acknowledg the great difficulty remains still how to account for the different changes of the specifical gravity of the Atmosphere; and to this I shall at present only say these two things, 1. That it is very ordinary and allowable

lowable to endeavour a rational account of the several Phenomena of a portion of matter from some known property of that body which it makes up or which acts upon it, tho' there cannot presently be given a Mechanical account of that property its selfe. Thus all the appearances, which were formerly resolv'd into a *Metus Vacui*, are now accounted for by the weight and spring of the Air, tho' the Air's weight and spring be not resolv'd into their true Mechanism. And in this all I aim at is to offer the most natural and rational method for resolving the ordinary changes of the weather, and to make appear that 'tis more easie and intelligible to account for the falling of rain and the impetuosity of Winds by the change of the Atmosphere's gravity, then to explicate the change of the Air's weight from the rain and Winds.

But now as to the thing its self, there can hardly be expected a satisfactory account till we come to know the cause of gravity in general, and of the Air's weight in particular; and therefore I shall only here offer 2 or 3 hints which perhaps may incite others to consider it more narrowly and 1. it is now almost generally acknowledg'd that there must needs be a fluid much more subtil then common Air and of a far greater pressure then Air which is the cause of the continuity and cohesion of all terrestrial bodys, and in which the Air seems as it were to float and to have the same relation to it, as the Vapours do in and have to the Air, and therefore if we could reach its nature and properties it might be considered what influence this may have upon the change of the Air's gravity. Or 2. Seeing the Infusion of one Liquor into another in Chymical preparations will alter its specifical gravity so that the bodys which were formerly born up in it, will fall down and be precipitated (as the particles of Gold floating through *Aqua Regis* will be precipitated by the infusion of another Chymical Liquor,) it may be considered whether plenty of Nitrous Steams or some such mixture

mixture may not alter the Air's specifical gravity. Or 3.
 We may possibly come to a nearer resolution of this by considering the influence which the Heat and Cold have upon the Air's spring. The Air you know has this peculiar property which is not so much observ'd of other fluids, that it is indu'd with Elasticity as well as gravity, and therefore we are to consider what influence the change of its spring may have upon the change of its weight, and it seems evident that the encrease of its spring doth diminish its weight, and the lessening of its spring will encrease it: for upon the encrease of the Air's spring, the Air is rarefied, and so a lesser portion of it presses upon the subjacent fluid, but when it is lessen'd the Air is condensed, and so a greater portion of it presses upon the subjacent body. For example let us suppose the springy particles of Air, to be like to the springy hairs of Wooll, or the spring of a Watch; and that many Millions of rows of them go to make up the Cylinder of Air which from the top of the Atmosphere presses upon the Mercury in the Baroscope and keeps it suspended to the height of 30 Inches; let us suppose this Air rarified, so that all its springy particles expand themselves, and therefore shut off of this Cylinder some Thousands of those rows; this Cylinder being now made up of a far lesser number of those rows of particles, must needs have a lesser pressure upon the Mercury, so that it will subside perhaps to 29. And thus it continues till the Air's spring be weakned, and so the particles crowded again into narrower room. Now if this be found to hold in the Theory, Experience seems very well to answer it; for I have hitherto observ'd that in Cold weather and sharp Frosts the Mercury rises highest in the Baroscope, and if the forreign measures agree with ours it is usually higher here than in *France* or *Italy*.

I shall here after all subjoyn two or three observations which may serve to confirm what has been said. The first

first is of the course of the weather under or near the Line. I have read in the 2d, and 4th, parts of *Purchas his Pilgrims*, (and I doubt not but later Travellers attest the same truth,) that in *Brasil* and *Guiana* in *America*; in *Guinea*, *Congo* and *Æthiopia* in *Africa*; in the *East-Indies* and the *Maldivè Islands*, they have almost continual floods of rain from about the beginning of *May* to the end of *August*, which they call their Winter, and the rest of the Months of the year fair and clear weather, which they call their Summer; so that when the Sun is nearest to them they have constant rains, and when remotest, fair weather. And this I impute amongst other causes to the extraordinary rarefaction of the Air and lessening of its specific gravity there at that time, so that the Vapours in the Neighbouring parts of the Air do all flow thither, and descend as it were in floods of rain. And as this is reckon'd to be the cause of the Inundation of the Nile and some other Rivers, so perhaps this may be the reason also why those *Countries* which are Neighbouring to them, and somewhat remoter from the Line, such as *Ægypt* and the like, have seldom or never any rain.

My 2d, Observation is of the Baroscope *viz.* that when the Wind is North, North-East, or North-West, the Mercury ever rises, and so the Air is heavier, but when the Wind comes from the South, South-East, or South-West, it falls and so the Air's gravity is less; by which we may see what Influence the Cold and Heat have upon the Air's weight; and you know a Cold Wind is said to drive the Sails of a Ship much more forcibly than a Warm.

My 3d, Observation is of an Experiment of the Honourable Mr. *Boyle* as I find it set down in the Philosophical Transactions *Numb.* 63. Pag. 2048, 2049. I made, *saieth he*, by Distillation a blood red Liquor, which chiefly consisted of such saline Spirituous particles as

may be obtain'd from the masse of blood in human bodys; this Liquor is of such a Nature that if a Glafs Viol about half filled with it be kept well stoppt, the red Liquor will rest as quietly as any ordinary one, without sending up any Smoak. But if the Viol be unstoppt so that the external Air be permitted to come in, within a quarter of a Minute or less there will be elevated a copious white Smoak, which will not only fill the upper part of the Glafs, but plentifully pass out into the open Air, till the Viol be again stoppt. And a little after he addes ----- If the unstoppt Viol were plac'd in our Vacuum, it would not emit any visible Steams at all, nor so much as appear in the upper part of the Glafs its self that held the Liquor; whereas when the Air was by degrees restor'd at the stop-cock, the returning Air would presently raise the Fumes first into the vacant part of the Viol, whence they would ascend into the Capacity of the Receiver; and likewise when the Air that was requisite to support them was Pumped out, they also accompanied it as their unpleasant smell evinced, and the red Spirit, tho' it remain'd unstoppt, emitted no more fumes, till the new Air was let in again; so far He. Such you see was the proportion between the gravity of the Vapours of this red Liquor and the Air, that the Air being in its ordinary degree of gravity these Vapours did ascend; but the Air's gravity being much lessened in the Receiver by the Pumping out a great deal of it, and so expanding the springs of the rest, it was not able to elevate those Vapours.

Thus, *Sir*, in obedience to your Commands, I have scribbled over my thoughts about this matter, and you see how necessarie it is for establishing a Theory of the weather, to have a more Universal correspondence in observing joyntly the Various changes of the weather in distant places; the several quarters of the Wind, their strength, the time of their rise and continuance; the various

rious changes of the Baroscope observed by an Universal measure agreed upon; the changes of seal'd and open Thermometers, of Hygroscopes, &c. And the Latitudes and Longitudes of the places. I doubt not but there may be several Inquisitive Persons engag'd in making such remarks; and if it were thought fit to employ the excellent Correspondence which has been established throughout the Learned World in publishing such joynt observations, as they do many usefull things in other parts of the History of Nature, we might possibly arrive at a more determinate and usefull knowledge of the nature and causes of Vapours, Wind, Rain, &c. and the various alterations of the weather, and find out this *Proteus* in all its changes.

A Discourse concerning the Air's Gravity, observed in the Baroscope, occasioned by that of Dr. Garden; presented to the Phil. Soc. of Oxford, by the reverend Dr. Wallis, President of that Society. April, 14, 1685.

THE Discourse of Dr *Garden* (read at our last meeting,) concerning the different state of the *Air*, in respect of its different gravity, hath in it a great deal of very ingenious speculation. And what I then said to it, upon the first reading of it, and what I am now saying again to the same purpose, is not to contradict it, or detract from it, but to add to it; as a notion which I have long since considered, and judge it capable of further improvement.

The notion of the *Air's* weight and spring, hath been so well settled, by innumerable Experiments of this present *Age*; that hardly any considering Person doth now doubt of it.

And it hath chased away from before it, the notion of *Fuga vacui*, formerly received; by shewing us an efficient cause, of those effects, for which before we could onely pretend to a Final cause.

The first occasion (that we know of,) of introducing it, was, from *Galileo's* discovery, that water, by Pumping, was not to be raised higher then about three or four and thirty foot (or not much more,) of our *English* measure,

Which was a certain argument, that the cause of those effects (commonly ascribed to *Fuga Vacui*,) was but of a finite strength: whereas, if natures shunning a Vacuity had been the true cause, it was to have operated without stint.

Where upon this *Lyncean Philosopher* (as he was called,) did, out of his great sagacity, guess happily at the counter-

ter-balance of the *Air's* weight, as the true cause. And that therefore *Air*, which was before thought to be a light body, was but comparatively so, and had indeed a positive gravity, though less than that of other bodies which we are conversant with.

This notion, was happily pursued by (a Successor of *Galileo*,) *Torricellio*; who did rationally argue; that, if the *Air's* counterpois was sufficient to raise and sustain water at that height, and but to that height; then must it be a just counterpois to a lighter Liquor at a greater height, but, to a heavier Liquor, at a lesser height. And making an essay thereof in *Quick-Silver*, found it to succeed accordingly: and, in a just proportion to the respective gravities of those fluids.

And he hath, by this means, made the experiment (commonly called the *Torricellian* experiment,) much more manageable with *Quick-Silver* (in Vessels of about 29 Inches, *English* measure,) then before it was, with water, in much taller Vessels.

In pursuance of this notion, we find, by several sorts of Baroscopes (or weight-wisers,) not only that the *Air* hath gravity, but that it hath a different gravity, at different times and places; according as its counterpois is able to sustain *Quick-Silver* at different heights: sometimes a little lower than 28 Inches, sometimes a little higher than 30 Inches, and at other times at some middle height between these, here with us. Which different weight of the *Air*, or *Atmosphere*, may reasonably be supposed, partly to proceed from, and partly (as *Dr. Garden* well intimates,) to give occasion of difference in the weather and winds.

The particulars of his discourse (having not the Paper with me, and having but heard it once read,) I may possibly mis-remember. But, as to the main drift of it, (being a notion not wholly new to me,) I think I do not mistake.

That there is, in our *Air*, a body more subtle then are the Fumes and Vapours mingled with it, in our lower region, and which with it do make up that heterogeneous mixture which we commonly call *Air*; I think to be very certain. But whether that subtil body, be (as Dr. *Garden* seems to suppose,) much heavier, then our common *Air*; I much doubt. And do rather think it is not; not having hitherto observed any cogent experiment, either to prove it heavy, or elastick. But it may, for ought I know, be void as well of weight as spring: and, what we find of either, in our common *Air*, may be attributed to the other mixtures with it.

I know that this notion (of the greater weight of that subtler matter,) hath, by some, been made use of, to solve that (surprising,) experiment of *Quick-Silver* (well clenfed of *Air*,) being sustained in a Tube inverted (after the manner of the *Torricellian* experiment,) at a much greater hight then the usual standard (of 28, 29, or 30, Inches, even to the height of 40, 50, 60, or even 70, Inches; being steadily managed, and with great care. But I confess I am not satisfied with that reason: and think that it may better be accounted for otherwise, or else we are yet to seek for the true cause of it.

But we have no need of this particular notion, in the present discourse, and therefore need not be here solicitous about it: and shall therefore proceed without it.

The *Air* being, as hath been said, of a different gravity, in different times and places, (arising I suppose, from the different kinds and quantities of the Fumes and Vapours and other particles which are ingredients in it, and the different force of the Suns heat acting thereupon, increasing or allaying the spring thereof, and otherwise,) we are therefore to consider of the *Air* as a fluid who's parts are in some places heavier, and others lighter. And therefore much of a like nature as if they were different fluids, of different specifick gravities (as the word is now a-days

a-days,) or (as it was wont to be called, and, I think, better,) Intensive gravity, one from the other : (as, when we say, an Ounce of Lead, is intensively, though not Extensively, heavier then a Pound of Cork.)

Now when several fluids, or several parts of a fluid, are thus of different weights ; they will (from the general nature of heavy fluids,) when undisturbed, change places with one another, till the heavier becomes lowest and the lighter highest.

And this, not onely as to the minuter parts ; as is observed in Chymical precipitations, or the sinking of Sand in water, or its smaller earthy particles which subside in a muddy sediment, and the like of other Liquors when at rest, and the atoms (as they were wont to be called,) flying in the *Air* when disturbed, but subsiding in the form of dust when at rest. All which according as they be smaller do (*Cæteris Paribus*,) subside more slowly (as dust slower then a clod of Earth, and Filings of *Gold* slower then a lump of it, and thin Plates of Lead layd horizontally, then either a round Bullet of the same weight, or those Plates in a contrary position set edgewise,) and ought by statick principles (as is easily demonstrable,) so to do. But, much more, as to larger parcels. As when Oyl, Wine, Water, Beer, or other the like Liquors, are put together in the same Vessel ; as will be observable to the Ey, especially when their colours are considerably different.

Thus, if a Bucket of Water, be hastily taken out of a Pond, or a large Vessel full of it, the vacant place will be presently supplied with *Air* (as the nimbler fluid,) & then with Water flowing (by a declivity,) from the higher parts, and (because heavier,) thrusting out the *Air* (which had prepossessed the place,) till it come to a due Equipois.

And the same (from a like reason,) must happen, if some parts of the same Liquor, do accidentally acquire (by expansion or otherwise,) a greater degree of lightness then the other parts ; those lightned parts ascending,
the

the heavier subside. As when Water, Beer, or other thin fluids, be gradually heated by a fire underneath; the lower parts, being first warmed, ascending to the top, while the colder and heavier subside; whence we find, in such cases that Bubbles do arise, and that at the top is warmer then that at the bottom. But in case what is warmed, be of a thicker consistence, so as that the parts cannot readily shift places, that at the bottom will be hotter; and in case it be heated by fire over it, there will (I suppose,) be not such bubbling (or not so much of it,) that at the top being first heated.

From such consideration as this, Dr. *Garden* doth well observe, that some parts of the *Air* being thus (by rarefaction, or increasing the spring thereof, or otherwise,) become lighter then others; these heavier parts, rushing into the places of those lighter, may cause a wind as from such parts; (in like manner as, on a like occasion, a Tyde or Current would arise in water;) and other accidents of a like nature. And contrarywise, on a contrary occasion.

And this I take to be very true, (though such accidents happening very variously and uncertainly, will cause such confusion of motions, and disturbance of each other, that it will be hard to reduce them to a regular adjustment.)

But I add thereunto, that the Earths diurnal motion, compounded with its annual, (if we admit that hypothesis, as most do now a-days,) the one in some parts accelerating, in others retarding the other; and its difference in different times of the year, (by reason of the obliquity of the *Zodiack* to the *Equinoctial*,) and in different times of the month (because of the Moons different position, which is an Appendance to the Earths motion, and doth thereby differently affect it,) and according to the different place of the Earth and Moon, as to the Aphelion or Perihelion of the one, and the Apogæum or Perigæum

perigæum of the other: seem to me to be of much greater consideration, not only as to the Ebbing and Flowing of the *Sea*, (which I take to depend principally thereon, but to be variously modified also by the various positions of the continent on which it beats,) but as to the Winds also: especially the breezes and Trade-Winds; which at certain times of the day, or of the year, or of the month, are observed to blow constantly (or most frequently,) from such or such a Coast.

And I am not sure, that the body of Earth and Water (or *Terraqueous Globe*,) is exactly spherical (allowing onely for the small inequalities of Hills and Dales, which in a body of that greatness, are inconsiderable,) but may have somewhat of an oblong spheroid, having a longer *Axis* from Pole to Pole, then at the Equator. And though this cannot be much; because of the Earths shadow in the Moons Eclipse appearing circular, and the descent of heavy bodys being always (as to sense,) in a perpendicular to the *Horizon*: yet, if it be but little, this (with the compound motions before mentioned,) will give the *Air* a considerable disturbance.

To which I may add also, that we are not sure, that the *Seas* and continents (which are of very different comparative weights, Earth being heavier then Water,) are so adequately adjusted the one to the other, as that its center of gravity (by which a plain passing divides it into parts æquiponderant,) is the same with its center of Magnitude (by which it is divided into parts equally great,) which if it happen to be otherwise, will (with the rest,) make the confusions of the *Air's* motions yet greater. From the comparative weight or lightness of the *Air* at different times, he deduceth also the rising or falling of Vapours in it. As if, when such Fumes or Vapours, or other the like matters, are lighter then the *Air*, they ought (according to the exact rules of Hydrostaticks,) to ascend therein; but, when heavier then so, to fall

down. And this certainly (*cæteris Paribus*,) is to be admitted also.

Onely I add thereto; that these statick principles do chiefly take place, when things are otherwise at rest and quiet. But when they are in commotion, it is many times much otherwise. And, in such cases, we must, beside the respective gravity, take into consideration, the force, impulse, or impetus, that is superadded to the respective gravity of the parts or matter.

Thus, if a Bottle be shaken, the sediment at the bottom, (though heavier, and for which cause it did before subside,) will be mingled with the supernatant (finer and lighter,) Liquor. And, if a room be swept, it will (as we use to speak,) make a dust: that is, the small Earthy particles of dust, will rise and mingle with the *Air*: not because they be lighter then it, (for we see that, at leisure, they will subside again,) but because, by a force upon them, they be put into motion. So in a Jetty of Water (in artificial Water-Works,) the water is thrown up into the *Air* to a great height; not because it so becomes lighter then the *Air*, but because of the force impressed. (To say nothing of a Bullet, shot upward into the *Air*.) And Bottled Ale, when opened, flies many times upward to a great height; and sometimes blows up the Cork, to release it self from confinement. And, in the late Fire of *London*, not Paper only, but other things of greater weight, were mounted into the *Air*, and there carried aloft for many miles, and so taken up at more then Twenty miles distance.

And this I take to be the cause of Fumes, Vapours, and other like matters (most of them,) which ascend in the *Air*, not because lighter then it, but because impelled upward out of the bowels of the Earth, or from the superficial parts of it, either by some subterranean heats or other ferments that put them into motion, and force them upward; where they remain suspended in the *Air*, so long

as that force continues, or the force of others sent after them on the like errand (which rather impells them farther, then gives them leave to fall,) till either such force abate, or the great weight of so many things suspended, doth overpower, not only the *Air's* weight, but the strength of that, that impelled them.

And that there are such Fumes and other like matter projected upwards, from the Bowels of the Earth, and some of them with great violence, is undeniable, not onely from Earthquakes, and other eruptions (with great noises,) as well of Vapours, as of Burning *Mountains*; but even Poisonous Steams (and others,) in *Mines*, and Bubbling springs (where Bubbles of *Air* are seen to make their passage through the Water,) and other perspirations of *Air* or Vapour through crannies or small passages of the Earth, discoverable by Steams (whereof some will take fire at the light of a Candle,) or by the moving of Leaves and other light things laid on the mouths of such private passages, and by many other means. And to such causes I do principally attribute the Origine of Winds, and the ascent of most other things, which, from this lower World, mount into the *Air*. And, without this, the comparative gravity of the *Air* and them, would give us but a lame account of them.

There is yet another notion suggested, which is also very considerable as to this affair: which is, the weakening or strengthening the spring of the *Air*. That Water hath (of it self,) nothing of spring or Elasticity (otherwise then by reason of some *Airy* parts, or other elastick bodys, which may be included within it,) is generally held, at least none considerable, such as by any experiments hitherto made, can be clearly evinced so to be.

But, that the *Air* (such *Air* at least as is the common *Air* which we are conversant with,) is Elastick; is, I think, out of doubt: the experiments which prove

its spring, being so many and evident, beyond exception.

And, that this spring of the *Air*, is some times stronger, and sometimes weaker, I think is undoubted also. And, that the spring of the *Air*, is strengthened both by compression, and by heat, but in a different manner.

If the same quantity of *Air* be compressed into a lesser room, the spring is certainly stronger. As is undoubtedly seen in the Wind-Gun, and other compressive Engines. And from hence it is, that *Air*, of the common texture with the external or open *Air*, if it be (retaining its own texture,) included in a close Vessel (as in the *Air-Pump*,) whereby it is excluded from communication with the external *Air*, and defended from the pressure of it, doth yet sustain *Quick-Silver* in a Tube (after the *Torricellian* manner,) at as great an height, as the open *Air* by its counterpois would have done. Which cannot be by its weight (which, in this cause, is but small; and not equal to that of a cylinder thereof contained to the height of the *Atmosphere*;) but by its spring only; which is now pressed to as great a degree as it was in the open *Air* (by such weight as was then incumbent on it,) or would be now, if so again exposed. (Like as that of a Fleece of *Wooll* would be, if confined to the same dimensions it had, when a great pile of Fleeces was incumbent on it.) But if some of this *Air* so included (in the *Air-Pump* or such other close Vessels,) be Pumped out, whereby the residue thereof hath a greater room to possess than before it had, (namely, as much as before the whole of it did possess,) the *Quick-Silver* will presently subside, because the spring of the *Air* which did before sustain it, is now (by expansion,) become weaker.

Again; the same quantity of included *Air* in a close Vessel (so as not to communicate with the external *Air*,) will, by application of heat to it, have its spring strengthened, and drive its counterpois farther off, or (if need
be,

be,) compress it. As is to be seen in Thermoscopes of all sorts.

Whether, by strengthening the *Air's* spring (in that discourse,) he means that of the former or the latter way, I do not well remember. Nor, whether he apply it to the increasing, or diminishing, of its intensive weight. But it may be reasonably accommodated either way.

If the spring be strengthened by compression; it is manifest that the intensive gravity must be thereby increased: because the same quantity of *Air*, and consequently of weight, extensively taken, is now contracted into a lesser room, which therefore must be intensively heavier, (as being the same weight in a lesser bulk:) Now this may possibly, as a greater pressure or stronger spring, force up the Vapours under it with a greater *impetus* (according to the notion I mentioned before,) and so make them fly higher: (unless we should suppose, it may be relieved, by shortening the height of the *Atmosphere*;) but not so as to make them lighter; but rather the contrary, as pressing them closer: much less to make them (as the phrase is,) *specifically* lighter than is the *Air* it self (though thus compressed,) and it leaves less room to receive them between the particles of the compressed *Air*, as being now thrust closer together.

If the spring be strengthened the other way; so as by heat it useth to be: this doth rather diminish its intensive gravity, by thrusting its parts further asunder, and so possessing a larger room. Now in case this *Air* be, by a close Vessel, confined so as not to expand upward; it will certainly press the harder on the stagnant *Quick-Silver* under, and make that in the Tube rise higher. But in case it be unconfined, as in the open *Air*, it may as well relieve it self upward, by making the *Atmosphere*, in this part so much higher.

Nor is there any necessity, as to the subjacent parts;

that the *Atmosphere* should be every where of the same height. But the laws of Staticks, as to the subjacent parts, be equally preserved without it, (the greater altitude compensating for the levity of the parts,) as when a Portion of the *Sea*, is covered with a Fleet of *Ships*; the under parts are equally pressed, partly by water, and partly by *Ships*, though the tops of the *Ships* over some parts be higher then the surface of the water over others. One-ly, in such case, the upper part of the *Atmosphere*, being fluid, may flow collaterally over the other parts on either side if lower. And so, at leisure, (if thus remaining, otherwise indisturbed,) reduce it self to an equal height in all parts. Like as the *Sea* would do, in a perfect calm, though otherwise its waves and billows are far from being in all places perfectly plain and even.

But however, though the spring fortified by heat, may thus relieve itself upward, (yet because it presseth every way,) it must endeavour the like downward also, and thereby press harder on what is under it; and because it will require time to work upward gradually before the effect reach the top of the *Atmosphere*; and because, by such dilatation of its parts, more room is left in the intervals to receive what is forced: 'tis reasonable to believe, that, in such cases, the pressed vapours (*cæteris paribus*,) may rise more copiously then when the spring of the *Air* (for want of heat,) is less strong. The rather because the same heat which thus fortifies the spring of the *Air*, doth also rarify the Vapours and make them lighter: and may also fortify the subterranean heat (or what ever else it is,) that drives them up. Notwithstanding all which, we have more rains in winter; which should argue, that more Vapours do then arise to supply them.

But I suspect that, in this whole business (of strengthening the spring,) there may be a fallacy put upon us. And
what

what we think to be done upon the open *Air* ; is indeed done upon the *Quick-Silver* ; or rather upon the *Air* latent therein.

My meaning is this. We find that in very hot weather, and also in frosty weather, the *Quick-Silver* in the tube commonly stands very high ; from whence we are apt to conclude, that therefore the outward *Air* presses very hard on the stagnant *Quick-Silver*, without the tube. Wherein I am not satisfied.

For we are to consider, that, in filling the Tube with *Quick-Silver* before it be inverted, if great care be not used to cleanse it from *Air*, many aery particles will remain mixed with it ; which, while their spring is weak, are easily pressed by the weight of the *Quick-Silver* close as hardly to be discerned otherwise then by the effect ; but when, by the external heat, their spring is strengthened, they expand themselves, and cause the *Quick-Silver*, wherein they are, to swell in bulk, without increasing its weight ; and consequently to stand higher though not to press heavier.

Of this I had manifest experience, when (many years since) I did for five or six years together constantly observe the height of the *Quick-Silver* in the tube, and kept a register of it, and of the weather with it: and did for two or three of the first years observe, that in very hot weather the *Quick-Silver* commonly stood very high. But, for some of the latter years, I found it much lower in hot weather then in those former years. Of which I satisfied my self with this account ; that, in those former years, the Tube having been but lately filled, the aery parts remaining in the *Quick-Silver*, being by the heat expanded, made the *Quick-Silver* to swell and stand higher: but, when the *Quick-Silver*, by divers years standing unmolested, had by its own weight cleansed it self, and forced that *Air* (which had been in it into the upper part of the glass ; it now ceased to make the *Quick-Silver* swell higher,

higher, but rather (by expanding it self in the upper part of the glass,) pressed the *Quick-Silver* downward. And I suspect, that others (without heeding it,) may have been in like manner imposed upon, as I was; especially while their *Baroscope* hath been but newly prepared, and not well cleansed of *Air*.

And the same account, perhaps, may serve for its standing so high in frosty weather. Water, we know, though it contract with cold, yet when it comes to Frieze doth expand it self. (Which makes Ice lighter then water, and to swim on the top of it.) Now whether this be purely of it self, or (in part at least,) from the particles of *Air* lodged in it, may not perhaps be so easy to determine. However, if there be the like effects on *Air*, as on water, (namely, that it expands with Friezing;) or if, in the *Quick-Silver* there be lodged particles of water as well as of *Air*; we have, either way, an account of this Phænomenon. For, then, the small particles, whether of *Air*, or water, lodged in the *Quick-Silver*, being thus expanded by friezing, will make the *Quick-Silver* swell, and so stand higher, without increasing its weight; and consequently, without arguing a greater weight of external *Air* pressing on the stagnant *Quick-Silver*.

*The Description of a Stone of the Bladder, seen
by the Royal Society, Feb. 25th, 1684.*

THIS Stone is represented *Fig. 1.* and is said to be taken out of the *Bladder* of one *Francis Dugood* of *Auchenhove* in *Aberdeen*. The man, who bred it, lived till he was 50 years old: the length of it is $5\frac{2}{10}$ Inches; the Diameter $3\frac{6}{10}$; the weight two Pound, three Ounces, and six Drams.

*An Account of an Aqueduct design'd for carrying
the River Eure to Versailles.*

THE *Aqueduct* which is to be made neer *Maintenon*, for the carrying the River *Eure* to *Versaille*, will have in length 7000 Fathom; 462 whereof will be 35 Fathom and 4 foot high, the rest will be lower according to the difference of the ground, but not less then 5 foot and 6 Inches high. There will be to the said *Aqueduct* 861 Arches, which, where they are highest, will have 12 Fathom in bredth and 8 Fathom in thickness, diminishing to 14 foot at the top. The other Arches will be lesser in breadth, as well as thickness, according to the Nature of the ground. The said *Aqueduct* will have 15 Inches fall to every 1000 Fathom in length, so that for the 7000 Fathom, there will be 8 foot 8 Inches fall. The River is to pass by *Maintenon*, *le Parc Espéron*, *Gajeran*, *Ramboillet*, *les Effars*, *le Perrey*, *Cognieres*, and from thence to *Versailles*. There are 14000 Soldiers that work thereat, under the Command of the *Marques d'Uxello*, with three Commissarys of War for their Conduct, together with Treasurers, Pay-Masters, and Victuallers.

An Account of an old Earthen Vessel, lately found near York.

THIS Earthen Vessel describ'd *Fig. 2.* suppos'd by some to be an *Urn*, by others to be a *Flowerpot*, was found lately at the Brickkilns without *Bowthant Bar*, near *York*: the Clay of this Vessel is of the Colour of *Hallifax Clay* when burnt; the Potters part is well perform'd; the Face being boss'd from within, with the Finger, when upon the Wheel; and some stroaks of Red paint, about the curls of the Hair, and Ey-brows; and two Red threads about the Neck: on the back-side of the Vessel, a *Leaf* is drawn in Red, which is still very fresh; but no Glazing, neither upon the Clay nor Red colour; the Face upon the Vessel is as large as that of a middlesiz'd Woman: the Vessel it self is preserv'd in the *Musæum Ashmoleanum* at *Oxford*.

An Abstract of a Letter from Dr. Peirce of Bath, to one of the S. of the R. S. giving an account of a Shell found in one of the Kidneys of a Woman.

Sir.

THE Account of the *Shell* found in the Kidney of a Woman is as follows; A Gentle-Woman of about 28 years of Age, very Fat, and Corpulent, after having been long troubled with frequent, and sometimes violent Vomitings, fell at length into a Feaver, which had no very ill Symptomes at first; yet she died in few days, and on a sudden: for the satisfaction of her Relations, the body was opened; the lower Region being first examin'd, I quickly found what might account for her long Vomiting (and perhaps her Feaver and Death too,) *Scil.* an Ulcer in the *Pancreas*; which had sphacelated some part of the Stomac and Bowells, that lay nearest to it. But there having been many things taken for the Stone, (many Physicians, as well as others, imputing her Vomiting to that Distemper,) I was willing to see in what condition her Kidneys were. They were covered with a prodigious quantity of Fat; which removing with my hand, and reaching one of the Kidneys I felt something prick my Finger in the lower part of the Kidney where the *Ureter* is inserted: I presently concluded it to be a *Stone*, and kept hold of it till I made my way to it with my knife and took it out (with an abundance of mucous bloody matter about it,) and laid it by in the window; opening the Kidneys, I found not so much as *Gravell* (much less any *Stone*,) in either of them: upon further examination of this matter, (suppos'd to be a *Stone*,) by washing off the mucus that was about it,

I found it to be a small *Shell*, very finely Wrought; in the hollow of it there was a mucous slimy matter, not at all unlike the substance of a snail as to consistence ; but of a bloody colour.

Fig. 3d. Represents the *Shell* in its true bigness. *Fig. 4th.* shews the same *Shell* somewhat magnified : those indented Checkers, are every other a little depres'd, and elated : and very exactly Wrought : there are six or seven spiral lines or Rounds, in the Turban.

I am

Sir Your very

Bath April 11th,

Humble Servant

1685.

ROBERT PEIRCE,

Gualteri Charltoni Inquisitio Physica de Causis Catameniorum, & Uteri Rheumatismo. Lond. 1685. 8°.

THE Learned Author, designing to treat of the *Fluor albus* which he terms *Rheumatismus Uterinus*, gives the Anatomy of the *Womb*, (in a proper sense,) describing the Magnitude, Substance, and Vessels of that part; particularly, the *Tubuli* peculiar to it, and opening into the Cavity of the *Womb*, with orifices easily discernable in Women far gone with Child; as the Author himself has observ'd: having laid this foundation in Anatomy, he inquires into the nature of the *Menses*, the design of which, he thinks, is (already well stated by another hand,) for the carrying off the vitiated serous matter of the *Succus nutritius*: as to the *Efficient* cause of this Evacuation, rejecting the opinion of *Aristotle*, and the *Egyptians*, (who insisted on the Influence of the Moon,) he examines the modern *Hypothesis* of a *Ferment* lodgd in the *Womb*, & raising the *Blood*, in a months time to such a pitch, as to cause the usual Flux; against which he endeavors to prove *That the Blood never Ferments in a living Animal*, &c. Because of all Humors in the Animal Body, it is (as the Author says,) least apt to Ferment. 2ly Because there is no Fermentation (as the Author again affirms,) where there is not an *Acid*, some way, or other concern'd. 3ly Because the Circular motion of the *Blood*, and Chyle in it, is so very rapid, as not to afford time and leasure, requisite to Fermentation. 4ly Nor is there room or space in the Heart or Blood Vessels, for the carrying on this work. 5ly He thinks it repugnant to the Prudence of Nature, to constitute a twofold motion, (that of the circulation, and that of the (suppos'd,) Fermentation, in the *Blood*, where one of them (the former,) is sufficient. All which being taken for true; he thinks the notion of the *Fermentum Uterinum*

Uterinum will in a manner fall of course ; especially, if it be farther considered, that the *Blood* rushing thro' the *Capillary Blood Vessels* of the *Uterus*, cannot (as the Author thinks,) be affected by any such Ferment, if there ; and if it should tarry there long enough for this purpose, (he supposes,) the consequence would be an Inflammation, or a *Ichirrous Tumour* of the part, or a *Chlorosis*. As for those symptoms, which coming at the approach of the *Menfes*, seem to argue for a Ferment ; he deduces them from the Impression made on the Nerves of the *Uterus*, and the Membranes appertaining to it ; the Sympathy arising in other parts of the Body, partly from the communication of Nerves, partly from the continuation of Membranes.

Having thus (as he thinks,) refuted this opinion, in the next place he gives us his own ; where explaining the Analogy between plants and Animals, the Earth, and the *Matrix* (especially in Women,) he observes that as heat, salt, and moisture make the Earth fruitfull ; so likewise in Women (he says,) there is a *Fervor Uterinus*, *quodum intumescit Uterus, omnia ejus Vasa sanguifera, pori omnes, omnesque Tubuli Membranei laxantur, distenduntur, restituuntur ; ut motu Restitutivo se contrahentes exprimant quicquid vel sanguinis, vel serosæ ac pravi succi alimentaris materiae in ipsis eo tempore continetur*. This *Fervor*, he thinks, proceeds from an *Acidity*, which in the space of a month, is contracted in the *Succus Nutritivus* settled on that part : and the reason why no Creatures, beside Women and Apes, have this Evacuation, he supposes, is from the *Tubuli Uterini* (the excretory Ducts in this case,) peculiar to them. This being the sum of his *Hypothesis*, he endeavors to explain some more remarkable *Phenomena* in a manner agreeable to it ; and then passes from the strait to the crooked Line of Nature, the *Rheumatismus Uterinus* ; where having confuted the opinion, which many Physicians have had of it, He gives

a History of the Disease, shewing the universality of it, (all persons of the other Sex being liable to it;) the Symptoms attending it, (such as are a Lassitude, want of Strength, especially in the Legs, an ill habit of Body, and sometimes Pains, &c:) and the nature of the humor dischargd. As to the origine of this humor, he looks on it to be some of that part of the *Succus Nutritius*, which (he thinks,) is brought from the Stomack and Intestins, by *Fibres*, to the *Uterus*: but that which gives rise to, and is the Efficient cause of this Distemper is one or more of the following particulars; *viz* 1 a Laxness in the texture of the *Womb*. 2 A disuse of the Glands of that part. 3 Some Injury done the Lymphatics or 4 the Tubuli in it; 5 A *Solutio Continui* in the same part. Last of all he gives some particulars which distinguish this disease from the *Gonorrhœa* in Women; a Distemper seated in the Glands *Prope Meatus urinarii exitum*, accompanied with a heat of Urine, and a strangury, and continued without any long Intermision; which instances do not hold true of the *Rheumatismus Uterinus*.

Davidis Abercrombii M. D. *de variatione ac varietate Pulsus Observationes. Accessit ejusdem Authoris nova Medicinæ tum Speculativæ tum Practicæ Clavis, &c.* Lond. 1685. 8°.

THE Author in this tract among the various opinions of the Cause and Origine of the *Pulse*, thinks it more probably to proceed from the joynt motion of the *Spirits, Arterys* and *Muscles*. And as to the *Variation* of it assigns these for most certain causes, *viz.* The *Climate, season, (or time,) Temperament, Age, Diet, Passion, Disease*; to which might be added perhaps many more.

The *Climate* alters the *Pulse* according to the different influences of the *Heavens*, or Vapours of the *Soil*. Hence the *French* mans *Pulse* is more equal and quick, the *Germans, Dutch, English*, and *Scots* more uncertain; which yet is something to be attributed to their irregular living; in generall the higher and nearer the Sun is, the quicker; the lower and farther off, the slower is the *Pulse*. And, he thinks, for the most part the *Systole* is more quick then the *Diastole*. In rainy seasons the *Pulse* is more free & nimble, by reason of the less preffion of the *Atmosphere*. It is more impetuous in the spring; more equal after a quiet sleep; weak and uncertain in men very intent upon business, &c. The *Temperament* results from the *Animal Spirits*, and the contractive or dilative motion of the *Muscles* and *Arterys*, to which their fibres are even by Nature disposed. *Melancholy* renders the *Pulse* extreamly unconstant, probably through the great thoughtfulness of such men. In *Bilious* tempers it is high and strong, in the *Sanguine* more equall and regular then in any, in the *Phlegmatic* equall enough too, but more slow. In Children, especially Infants, the *Pulse* is very small,

but through the great quantity of *Lympha*, as it were drowning and dulling the action of the spirits. In old men extreemly uncertain. In gluttonous People dull and slow unless by drinking it be made as it were stumbling and vertiginous, which often foreruns suddain Deaths. By too sparing a *Diet* it becomes very small and slow, always abates upon long fasting. Of the *Passions* it is most altered by *Fear*, *Joy*, and *Anger*. To which Women are more subject then men. In *Feavers* the *Pulse* is varied according to the beginning, height, and declination. In *Scorbuticall* and *Hystericall* Persons, very uncertain. In *Istericall*, and *Hydropicall* much stopt, and interrupted by the stagnant humors. In the *Gout* free and expedite. In the *Plague* (as in the *Asthma*,) mightily oppressed, unless freed by the hot Fit. In general any variation of the *Pulse*, certainly speaks some alteration in the habit of body.

The *Pulse* is *unequall* either in respect of time, or strength, that is, either it strikes quicker and slower, or else, stronger and weaker. The first commonly in most acute distempers, and seldom betokens much danger. The latter both in *Chronicall* and acute is very dangerous. And often (sometimes 2 or 3 days or more,) foreruns Death. It is *Interrupted* when its stroakes are much smaller then usuall, or their intervals much greater. The first shews a great decay of strength. The latter, (which is as it were a standing-still,) foreruns swooning, Palsy's, Apoplexy's, &c. And sometimes Death it self. The *Intense Pulse* is, whose stroak is very hard, (the parts as it were being upon a Bent,) or else this strength is made up with the multiplicity and frequency of less mications as in the height of Feavers. The *Remiss* hath stroaks less quick or less strong, and in Sickness shews more danger then the other. The *Superficial Pulse* shews an exact temperament of Body, as also a free and merry temper of mind. The *Deep Pulse* shews a disposition to Melancholy,

ly, Asthmas, Lethargys, &c. And is more frequent in the aged then the young. The *Leaping Pulse* often portends no great danger. The *Trembling* shews great extremity, and very few ever recover after it. But the *wandering Pulse*, (which sometimes is felt at one place, sometimes at another, and sometimes no where,) never but some few minutes precedes our solution, which yet may perhaps from volatile spirits sometimes receive a short reprieve, but never a perfect restitution.

The design of the other tract is to teach us to discern the virtue and quality of any Plant or other Body (without the particular knowledg of the species or name of it,) only from the Taste: which he says is either *Sour*, as the sharp leav'd Dock or *Olus Sylvestre*. *Harsh*, as the Medlar. *Austere* or *Rough*, as the Quince. *Sweet* as the fresh juice of ripe Grapes. *Fat* and *oily* as the *Sesamum*. *Bitter* as the wild Cucumber. *Salt* as common Salt. *Tart* as Garlic. Or lastly *Insipid*, as the Gourd. All which sorts he treats of in particular.

Harsh (*Acerb*,) things are cold, binding, and repelling very hardly concocted; to be known upon the Tongue by their drying and contracting it.

Austere or *rough* differs from this only by degree, as being somewhat milder in its taste and weaker in its virtues.

Sour (*Acid*,) things are cooling, but never to excess, by reason of their penetrating part. *Acidity* may seem the first degree towards corruption, 'tis known by biting the Tongue without any heat.

Sweet things (and they only,) are nutritive. Their pleasantness arises from their being neither too hot nor too cold to the Tongue.

Fat things are moderately hot, in some measure therefore they moisten, soften, relax, and obstruct, are distinguished from *Sweet* things, by filling and as it were anointing the Tongue without that sense of pleasure, which these have.

Salt things are astringent, and deterfive; the one quality it hath from its Earthy part, the other from its Watery.

Bitter things are always hurtfull to the Stomack, unless by the astringitive qualitys they become proper.

Tart things are excessive hot, very naught for the head, good for heavy, Phlegmatic constitutions, known by the heat in the mouth. Lastly *Insipid* things have no peculiar quality, but are very cold and watery, and hurtfull to the Stomack, unless mixt with other things of a hotter tast and nature.

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FINIS.

PHILOSOPHICAL

TRANSACTIONS.

June, 22d. 1685.

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Part of a Letter from Sr. R. B. to Dr. L. concerning a new sort of Caleſh.

Sr. William Petty, Mr. Molyneux and I have ſpent this day in making experiments, with a new invented *Caleſh*, along with the Inventor thereof; 'tis he that was in London when I was there, but he never made any of theſe *Caleſhes* there, for his invention is much improved ſince he came thence; it is in all points different from any machine I have ever ſeen: It goes on two wheels; carries one Perſon; is light enough: as for its performance, tho' it hangs not on Braces, yet it is eaſier then the Common Coach, both in the high way, in ploughed Fields, croſs the ridges, directly, and obliquely: a common Coach will overturn, if one wheel go on a ſuperficies a foot and a half higher then that of the other, but this will admit of the difference of $3\frac{1}{2}$ foot in height of the ſuperficies, without danger of overturning: we choſe all the irregular Banks, and ſides of Ditches to run over, and I have this day ſeen it at five ſeverall times turn over and over, that is, the wheels ſo over-turnd as that their Spokes lye parallel to the Horizon, ſo that one wheel lies flat over the head of him that rides in the *Caleſh*, and the other wheel flat under him, but ſo much I call but once overturn'd. But what I have mentioned was another turn more, ſo that the wheels were again in *Statu quo*, and the Horſe not in the leaſt diſordered. If the Horſe ſhould be in the leaſt unruly, with the help of one pin, you diſengage him from the *Caleſh* without any Inconvenience. I my ſelf have been once overturn'd, and knew it not till I lookt up, and ſaw the wheel flat over
my

my head; and if a Man went with his Eyes shut, he would imagine himself in the most smooth way, tho' at the same time there be 3 foot difference in the height of the ground of each wheel. In fine, we have made so many and so various experiments, and are so well satisfied of the usefulness of the Invention, that we have each of us bespoken one; they are not (Plain,) above six or eight pound a piece,

Dublin,

May 5th, 1685.

An Account of a strange sort of Bees in the West-Indies, communicated by M. I.

A Friend of mine, Monsieur de Villermont, informs me, that he has received from *America*, a sort of Hony-Comb, (of a different make from the European,) which is composed of small Bottles, or Bladders of Wax, of a brownish colour, inclining to black : being as big as Olives, and shapt like the Spanish Olives. They hang together in Clusters, almost like a Bunch of Grapes, and are so contrived, that each of them has an Aperture during the time of work, but it is closed up, as soon as the Vessel of Wax is filled with Hony ; and then the *Bees* go to work at another Vessel.

Their Lodgings are ordinarily taken up in a hollow Tree, or the Cavity of a Rock, by the Sea side ; these being the properest places to secure them from such Animals, as are geedy of their Honey, and therefore likely to molest them ; and they have the more need of this Caution, because they are more lyable to be disturbed, then ordinary *Bees*, as having no Stings, and being capable of doing good, but no hurt to any thing, as the Party that lived at *Cayenne*, very well knows. When the Combs are removed, they must be carryed gently, and in the same Position they lay in till you come to the place, where you design to take out the Honey.

The Honey it self is clear, and liquid as Rock-water, and hardly to be distinguisht from it, by the sight ; when you would take it out, you must pierce every bottle, with the Thorn of a wild Palm, or a Pin, a little more then ~~from~~ from the bottom ; for if you pierce it lower, you find a bottom or sediment, whose thickness would hinder it from running : as you prick every Bottle, you have some Vessel ready, to receive what comes from it. My Friend
tells

tells me, he thinks, the liquor is one of the most agreeable things in the world. If you drink tasting, the quantity of a good Glass, or about half a pint, it will give you 2 or 3 stools, in about 2 hours time, according to the temperament of the Party; but if you drink it at Meals, it does not purge at all.

My friend has also a sort of *Cinnamon*, which comes from *Guardaloupe*, which is white; and another sort, which comes from *Maragnan*, which is like that of *Ceylon*.

He promises to shew me, that *Ambergrise* is nothing but the wax, mixt with the Honey, which falls into the Sea, and is beat about in the Waves, between the Tropics.

He has an Ear of the small *Melium* of *Guinee*, about 10 Inches long, made just like the great knob of a Cane; the Grains are no bigger then a pins head, and are very good to eat, the *Negros* making their finer Cakes of them.

Monsieur Villermont having lately sent over one of these Honey-combs; care has been taken, for the designing, and engraving it; 'tis represented Fig 1. Only allowance must be made for some of the Bottles having been broken in carriage.

*A Letter from William Molyneux Esq; Sec. of
the Dublin Society; to one of the S. of the R. S.
concerning a new Hygroscope, invented by Him.*

Dublin April, 17. 1685.

Sir,

FOR want of some thing better to send you, I shall briefly declare to you the contrivance of a *Hygroscope*, which I have lately invented and put in execution with good success. I do not know that any one has mentioned, or so much as hinted at the like, and therefore to me 'tis altogether New; but if any one has been before-hand with me, I shall not in the least contend for the Glory of it.

Fig. 2. *AB.* is a Whipcord about four foot long, tyed fast to the end of the Hook *A*. At the end of this Whipcord there hangs the Weight *C.* about a pound or something more; this weight is so fitted at the end as to receive and carry the Index *D.* under these there is placed a Graduated Circle on the Board *EF.* Fixt by a Bragget against the Wall.

All things being thus adapted, the moisture of the *Air* twists the Rope and gives a motion to the Index over the divisions in the Graduated Circle; and again as the *Air* grows more dry, the Cord untwists and brings back the Index by a contrary motion.

That which first gave me the Hint of this, was the observing all Ropes tyed at both ends to be much more tite & stretched harder after Rain has fallen on them then before; I concluded that if I could (as it were,) ty a Rope at both ends and yet give one end a liberty of Circumvolution; it would perform my desired end; now the
Weight

Weight *C* hung at the Rope does this, for it fixes (as it were,) the end of the Rope *B*, and yet it permits it to twist and untwist. And the reason of this twisting and untwisting is plain; for the little particles of moisture insinuating and soaking into the Cord are like so many Wedges, which must needs shorten the Rope, as a Bladder is shortned by being blown up, and will lift a great weight (as Dr. *Wallis* discourses at large in his *Mechanicks*;) but the easiest way for the Rope *AB*. to shorten and lift up the weight *C*. is to do it by way of screw; for it self is a screw, the strands thereof being twisted (and each particular thread in it,) screw-wise, and consequently must give a circular motion to the Index.

To make an experiment of this, I wetted a Cord and hung it up with the Weight at the end of it, and I perceived as it dryd it untwisted, and that too very quick, so as to be perceived by the Ey; after the Cord had so far untwisted, as I thought it had come to that degree of dryness, that the present Constitution of the *Air* would permit, I took a basin of warm water that sent out a Steam and Fume, and placed it under the Cord; immediately the Cord began again to twist very quick, and so continued till the Water ceased Fuming, or was removed, and then immediately it began to return its twists. I then tryed to breath upon it gently with my breath, and found according to my expectation, that 8 or 10 breathings would twist it 5 degrees of a Circle. I then permitted it to the *Air* only, and for these last three weeks have observ'd its motion as affected by the Moisture and Drought thereof, and I find it to obey the alterations thereof most nicely; there falls not the least shower, at which it dos not presently twist; and when by rising Clouds a fair day becomes overshadow'd; the Cord is immediately sensible thereof, and again as sensible of their Vanishing and alteration to fair Sun-shine. So that I have seen it shew alteration, when not the least could

be collected from the sweating of Stones, cracking of Wainscote, &c. So that indeed I repute it to be the nicest *Hygrometer*, that has ever yet been used, and I am sure is as cheap and plain as any.

One of the grand defects of most (indeed I think of all,) *Hygrometers* hitherto invented is, that they grow weak with age, and do not so nicely obey the alterations of the *Air*, when long kept, as when first made; Planks and Boards grow more seasoned, and I beleive Oat-Beards will perish with time; but whether our present Invention be subject to the same fault, I leave to time to determine; in the mean while, give me leave to propose a reason which induces me to conjecture probably it will not have this defect; for our Cord performs its motion as it is a plyable soft screw, and that not only in its grosser part or strands, but even in its smallest threads; as long as ever this contexture screw-wise dos last (and this certainly must last whilst 'tis a Rope,) the motion that results therefrom must necessarily last, for the particles of moisture will insinuate themselves, and twist up the screw. But this I offer only as a conjecture, for I love to conclude nothing in natural Philosophy, till matter of fact and experiment confirm it.

There remains one thing to be observed of this *Hygroscope* (or *Weatherclock*; as an easier name to satisfy Ladies, that enquire what it is, as it hangs up in a Room,) that which I have described I have in my Closet, and I observe that the alterations of the *Air* that have happened in this time have given it more then one turn; now this being inconvenient, and the Duplication of the turn hard to be registred, as Mr. *Hook* proposes in his *Micrography* pag. 150. concerning the beard of a wild-Oat; I have thought of a way for remedying this, for it being in our power to increase the Diameter of our graduated Circle as large as we please, what need have we of more then one turn from the greatest degree of moisture

ture to the greatest degree of Drought? Now suppose I find the *Hygroscope* represented in the *Figure* to have two compleat Revolutions (this is to be found by observation throughout a whole year,) I say then the way of rectifying it is thus.

In *Fig. .2* the Index *D.* has two Compleat turns; the point *A.* as being fixt has no turn or motion, therefore the middle point *G.* has but one turn, and consequently if I hang it up at the point *G.* or no longer then *G D.* half the former length, the Index *D.* will have but one turn. What is here said of two turns and the middle point *G.* may be accommodated to any other number of turns and parts, and points in the Rope,

Lastly, *Sir*, we may in this experiment perceive something that may help us in the consideration of the strength and motion of the Muscles of Animals; for take a Cord able to sustain an Hundred pound weight, by the weak Fume or Steam of warm water this weight shall be lifted up; for if this Steam turn the weight (as most certainly it will do, if the Rope be of any moderate length,) the weight is as certainly lifted up thereby as by a screw, as is evident to any one that considers it. If therefore such mighty performances can be produced by the application of such mean agents, as we all know and are conversant with, what shall we think is too great for those parts which *God* has contrived and framed in the Bodies of Animals?

I am

Your most Humble servant

WILLIAM MOLYNEUX.

P. S. I forgot to mention one particular, that is, apply a Candle or Heated Iron nigh the Rope and it makes it twist very quick, contrary to Mr. *Hook's* Oat-beard.

H h 3

Soma

Some Observations on the French Macreufe, and the Scotch Bernacle ; together with a continuation of the Account of Boyling, and other Fountains. By Dr. Tancred Robinson Fellow of the Royal Society.

I Find so many mistakes amongst Natural Writers, and some learned Men, concerning the Bird at *Paris* call'd *Macreufe*, and in other parts of *France*, *Macroul*, or *Diable de Mer*, that I think it no improper subject for the entertainment of Your Curiosity. The *French* eat it upon Fish-days, and all Lent, thinking it to be a sort of Fish, or a Marine Animal with cold blood, or else a *Bernacle* generated either out of rotten or corrupted wood floating upon the Sea ; or out of certain fruits falling into the water, and there Metamorphosed into a Bird ; or else from a kind of Sea-shells adhering to old Planks and Ship bottoms, called *Conchæ Anatiferae* ; whereas the *Bernacle* (as also the *Macreufe* it self,) is Oviparous, and of the Goos-kind ; and the shells themselves contain a testaceous Animal of their own species, as the Oyster, Cockle, and Muscle doth. *Gesner* himself (though the most learned, diligent, and faithfull of any that ever meddled with the History of Animals,) was lead into the first errour by *Gyraldus*, *Boethius*, and *Turner* ; Sr. *Robert Moray* fell into the third and last mistake *Philosoph. Transact.* N. 137. The learned Sr. *Robert Sybbald*, and *Monsieur Graindorge* have indeed confuted these æquivocall Generations of the *Bernacle* and the *Macreufe* ; yet they both make them to be the same Bird ; *Prodrom. Histor. Nat. Scotiæ* ; and in the *Histoire des Macreuſes* ; whereas they are of different Tribes ; the *Bernacle* of the Goose, and the *Macreufe* of the Duck-

Duck-kind. The many Vulgar errors concerning the Origine of these Birds, have sprung from the positive Relations of unwary Observers; and from the Writings of great men, as *Munster*, *Olaus Magnus*, *Cambden*, *Carran*, *Lesley*, *Julius Scaliger*, *Wormius*, *Mayerus*, &c. *Kircher* (though credulous enough) himself, mistrusted their Relations, and fancied that the Eggs of these Birds might sometimes float from the Northern Seas upon these Coasts, and there sticking to, and hatching upon Planks, Ship bottoms, Trees (or any rotten wood,) might give occasion to the rise of the aforementioned mistakes. That the *Bernacle* and *Macreuse* are both oviparous, is beyond all doubt; the Anatomy of their parts serving for Generation; many late Voyages into the North; their laying Eggs; and sometimes breeding among us, are all evident proofs thereof.

Monsieur *Cattier* in his *traité de la Macreuse* doth affirm that the French *Macreuse* is the greater Coot of *Bellonius*; and Mr. *Willughby Ornitholog*: p. 320. seems to be of the same opinion; there are some learned men, who think the *Macreuse* to be the *Puffin* of the *Sillies*, and *Isle of Man*; others take it for a sort of *Colymbus* or *Mergus*, *Doucker* or *Diver*; but after all the French *Macreuse* is of the Duck-kind, and is the *Scoter*, or *Anas niger minor* described by Mr. *Ray* in Mr. *Willughby's Ornitholog*: p. 336. As the Skins of the Male and Female, together with their lively Pictures, brought lately from *Paris*, by that most Curious and Worthy Gentleman Mr. *Charlton*, do demonstrate; However for your greater satisfaction, you may consult Mr. *Ray's* letter, whose knowledge in the History of Animals, and of Nature in Generall, is as great and extraordinary, as it is particularly excellent in that of Plants.

The *Macreuse* is frequently taken in nets placed under water, upon the Coasts of *Normandy* (most plentifully at the mouth of the *Seine*,) of *Languedock*, and *Provence*;
and

and I am confident, I have seen it upon the *Laguna* of *Venice*, at the mouths of the *Breuta*, *Addefis*, and the *Po*. A Duck very like unto this (if not the same,) I saw upon the *Mare Mortuum*, and the Lake *Avernus*, as also many other Water-fowl feeding upon, and flying over that water, reported by many of our own, as well as foreign Writers, to kill Birds at a distance: I observed severall land Fowl to fly over that Lake, without the least disturbance, from all sides, and ends, North, South, East, and West; from towards *Cuma* to the *Grott* of the *Sybill*; from the mines of the Temple of *Apollo*, to where that of *Mercury* stood; But peradventure the Poysonous Steams (if there are any peculiär to that Lake,) sometimes vanish, and return again, or else may be alter'd by new *Effluvia* intermingled with them.

When I delivered my thoughts concerning *Boyling Fountains*, their Varieties, and causes, I had not then time enough to mention the *Burning* ones, except only that near *Wigan* in *Lancashire*, with which those *burning Fountains* near *Grenoble* in *Dauphinè*, near *Cibinium* or *Hermanstadt* in *Transylvania*, neer *Chermay* a Village in *Switzerland* in the *Canton* of *Friburgh*, and that not far from *Cracovia* in *Poland*, do agree in many particulars, as in being actually cold, yet inflammable and taking fire at a distance; upon the application of any lighted body; (which the *Boyling* springs neer *Peroul* will not do;) this ought to be understood of them in their Sources, because when removed from thence, neither the waters, nor their earths will produce any such *Phænomena*, as boyling, or flaming: It were worth the experimenting and observing nicely, what these waters, or their earths contain, or whether at any time some *Naptha*, or *Petrolæum* may not be found floating on their superficies; though I never yet heard that the surfaces of such springs, as throw up that Oily substance, would catch fire at a distance; neither is it affirmed (that I know

know of,) by any writer, that any hot Boyling Fountains will take flame at a distance, as some of the bubbling cold ones do. Monsieur *Boissieu* hath written particularly of the burning Fountain in *Dauphinè*.

Messrs Vette & Vollgnad have given their observations on the flaming springs neer *Hermanstadt*, but I do not remember that they made any particular Analysis of the water, Mud, Sand, Clay, or Earth, or any considerable tryals upon them; I am apt to believe, that there may be Veins of the *Pyrites* near those places, the inflammability of which Minerall hath already been discourd of, and made very clear by Dr. *Lister*, to whose papers I refer you, *Philosophical Transact.* N. 157. The ingenious Author of the letter from *Poland*, Printed in the *Journal des Scavans*, An. 1684; relating the History of a burning Fountain in the Palatinate of *Cracovia*, affirms that upon Evaporating the water a dark or Pitch-like substance may be extracted, which cures the most inveterate Ulcers in a very short time; and that the Mud itself is very powerfull against Rheumatick, and Gouty pains, Palsies, Scabs, &c. The inhabitants of an adjacent Village, drinking much of this spring, do generally live to 100 and 150 years, which he attributes to the sanative Vertue of the Water.

The *Naptha*, or bituminous substance floating upon a spring at *Pitchford* in *Shropshire*, and upon *St. Catharine's* fountain neer *Edinburgh*, hath been succesfully us'd in Ulcerous and cutaneous distempers; many such-like Fountains of *Petroleum*, and oily substances, are to be met with up and down, as in the Island of *Zant*, very plentifully; neer *Gabian* in the Road from *Montpelier* to *Beziers* in *Languedoc*; In the *Valtaline*. subject to the *Grifons*; at the foot of Mount *Zebio* in the Dutchy of *Modena*, not to mention any of the places written of already by *Varenius*. The Inhabitants living neer these fat oily springs take great care to gather and separate

the bituminous substances from the water, making very considerable advantages of them, for Mechanical, and Medicinal uses; I have seen them gather it up with Ladles, and put it into large filters; or into great Funnels stopt at the bottom, or else into Barrels set on one end, which have Spigots near their bottoms, when they are full and have stood a while, they open the spigot or stoppell to let out the water, and when the oyl or bituminous substance begins to come, they presently stop it again; the last of which Mr. Ray did likewise observe at *Gabian* in *Languedoc*. *Observ. Topograph.* p. 462. Whether they make use of any of these ways in *Zant*, I am yet to learn, though both the learned Sr. *George Wheeler* and *Monsieur Spon*, in their excellent Voyages have described the Pitch-springs of that Island.

*A Letter from Mr. Ray, Fellow of the R. S. to
Dr. Robinson ; concerning the French Macreuse.*

Sir,

I Had no sooner seen the Cases of the Male, and Female *Macreuse*, which you sent me, but instantly I found that the *Macreuse* was no stranger to me, though unknown by that name: I was very much pleased to be so suddenly rid of my long continued scruples about it, and not a little surprized, when I found it to be another kind of Bird then I imagined; a particular description of the Cock, you may find in Mr. *Willughby's Ornithology* pag. 366. of the English Edition, among the Sea-Ducks, to which kind this Bird belongs, and not to the *Divers* or *Duckers* (*Mergi* or *Colymbi*;) as I falsely fancied to my self. The first knowledge of this Bird, we had from Mr. *Jessop*, who sent us the skins of this among others stuf, from *Sheffield* in *Yorkshire*, by the name of *Scoter* as it seems they call it thereabouts; whether from the dark or black colour of it, or (which is more likely,) from *Scotland*, whence they might suppose it to come. Afterwards the Cock of this kind was found in the Market at *Chester*, by the then Bishop *Wilkin's* his Steward, who bought it; and brought it home to the Pallace, where I then hapned to be, and saw and described it. Last of all Sr. *Thomas Brown* of *Norwich*, sent among many others, the picture of this Duck; and Mr. *Johnson* of *Brignal* neer *Greta Bridge* in *Yorkshire* the Description, as I have related in the Book, and Page fore-quoted. I need not tell you how I distinguish the Sea-Ducks from the shallow or Plash-Ducks, because I have done it already in the place mentioned.

Mr. *Graindorge's* Description, which you sent me a Breviat of from *Paris*, I find upon attent reading and comparing with the case of the Bird, and mine own Description, to be very faithfull, and sufficient to lead into the knowledge of it, one, that had not been prepossessed with a strong opinion, that it was of another kind: had there been but one word added, that it was of the *Duck-kind*, I should then presently have apprehended what Bird it was; and yet there was enough in the Description to determine its *Genus*, at least to exclude it from those of the *Mergi* and *Colymbi*, and that was, that it had a flat bill, a note common to no other Birds that I know of, but the Goose and Duck-kinds. Notwithstanding what he saith of the debility of its feet, unfit for walking on land, I see not but that it may march as well as the rest of its kind, all which have but short and weak legs in proportion to the Bulk of their bodys, and those also situate very backward. What he saith of the smallness and weakness of the Wings, and shortness of their feathers, is common to many Sea-fowl, *viz.* the *Tridactylæ* and *Mergi*, which yet by the nimble agitation of them, fly very swiftly and strongly. What he saith of the mobility of the upper mandible of the Jaw, I shall not be too hasty to believe, as in a former letter, I remember to have written to you.

Now though this Bird hapned to be known to me by another name, yet it is so rare and uncommon, that I take it not to have been described by any that have written the History of Birds before; though (as I remember,) the name of *Mæcreuse* is mentioned by *Gesner* or *Aldrovand*, or both; why they of the Church of *Rome*, should allow this Bird to be eaten in Lent, and upon other fasting days, more then others of this kind, but especially the *Tridactylæ*, I see no reason; the flesh of these last, which live only or chiefly by preying upon fish properly so called, tasting stronger of fish, then that of any Duck, which

which feed upon shell fish; many Birds of the Duck-kind, which (as I said,) all feed partly at least upon shell-fish (as Monsieur *Graindorge* found the *Macreuse* also to do,) have a delicate and well tasted flesh, as for example, the common Mallard and Teal: whereas the flesh of all those kinds that feed wholly or chiefly upon fish properly so called, is of a Rank, ferine and piscesc taste, as for example, that of the Soland Goose, the English Puffin; and those of the tridactylous kind, so that only the young ones of those kinds are admitted to our Table. I observed in this Bird, and in some others of the Sea-Ducks that are much under water, that they want that Vessel or *Ampulla* situate in the very Angle of the divarication of the Wind-pipe, which for want of a better and fitter name, we are wont to call the *Labyrinth* of the *Trachea*; which though being common also to the *Colymbi*, which of all Birds dive most, and continue longest under water, we may very probably from thence conclude, that the *Labyrinth* doth not serve them for a Repository of *Air*, to enable them to continue the longer under water, as I sometimes conjectured; but for the intending and modulating of the Voice, seeing in the Plash-Duck, the females want it: but I am somewhat to seek about the use of this Vessel, and I think it were worth the while, to examine what sorts of Birds have it, what want it; whether the Males only, or in some the females also. I observed it in the *Mergus cirratus longiroster major* or the *Dun-diver*, and that very large, and extended by very strong bones, and yet I thought my self to have sufficient reason to Judge that bird to be the female of the *Merganser*: but I dare not be confident that it is a female because of this *Labyrinth*.

And now because I am writing of Birds, I propose it to your Consideration, whether that sort of Bird mentioned by the learned Dr. *Plot*, to be often heard in *Woodstock Park* (from the noise it makes commonly called the

Woodcracker,) be not the lesser sort of *Picus Martius Varius*, for since the publishing of Mr. *Willughby's Ornithology*, I have observed that Bird sitting on the top of an Oaken Tree, making with her Bill such a cracking or snapping noise, as we heard a long way off; the severall snaps or cracks succeeding one another with that extraordinary swiftness, that we could not but wonder at it: but how she made the noise, whether by the nimble Agitation of her bill too and fro in a rift of the bough, or by the swift striking of the Mandibles one against another, as the Stork doth, I could not clearly discern: but an intelligent Gentleman, who was very diligent in observing the same Bird, said it was the former way.

I am

Sir, Your Very

Humble Servant

JOHN RAY.

*Epistola Clariss. Viri Dni . Gulielmi Cole Med.
Doct. ad Honoratissimum Dum. Dum. Rob. Boyl
Armigerum, de Falsa Graviditate.*

I Gnoscat mihi Humanitas vestra, *Honoratissime Vir*, quod ignotus graviora, quibus in rem literariam (præsertim Medicam,) invigilas, negotia interpellare auisim. Eximius ille candor, quo cunctos, eos maxime quibus naturæ studium cordi est, prosequeris, hanc mihi fiduciam, ut ad te literas consignarem suggerit, nec de venia obtinenda dubitare finit, quandoquidem è Naturæ (cui Te ab intimis secretis nulli non suspiciunt & gratulantur,) penu, quod afferunt, depromptum invenies, Historiam sc. fati, opinor, raram; quam (nisi ejusdem fama ad aures vestras jamdudum pervenerit,) paucis hisce accipere digneris. Rei plurimos mihi testes tota habet vicinia.

Matrona quædam, mente omnino constans, pia, fide dignissima, & circa prægnantes & puerperas olim versatissima, septuagesimum nonum annum nunc agens, se fætum utero gestare jam diu credidit, creditque adhuc, imo quod magis mirabere (forsan & risu excipies,) per totos septem elapsos annos gestasse. Dum illac negotiorum causa quadriennio abhinc iter facerem, & à quibusdam, ipsa non minus credulis, rei famam acceperam, novitate permotus ad hoc miraculum nulla mora contendendi, ut tam insolita scena oculos pascerem. Inveni ventre multum tumentem, non autem, qualis esse solet hydropicorum tumor apparuit, sed sursum, more gravidarum, eminebat. Et dum plura sciscitarer, nec illam (ut nec ejus maritum, qui decennio minor uxore fuit,) de ingravitatione amplius dubitantem comperissem, petii ut tantæ fiduciæ causam exponeret.

Illa haud gravate respondit, se olim decem liberos enixam.

nixam, nec ab eo tempore per 28 annorum spatium mensum fluxum passam, in eum tandem satis copiosum incidisse, ex quo brevi post omnia conceptus signa apparuerunt; inde nauseam, & vomitiones subinde recurrentes, necnon & inordinatam quorundam præ cæteris ciborum appetentiam, ut prægnantium mos est, invasisse, & per plures menses perstitisse, ventre paulatim intumescente; postea solito tempore primos fætus motus se percepisse, & exinde, tumore indies aucto, motus etiam tanquam ejusdem locum sæpe variantis, nunc ab una nunc ab altera ventris parte, qui & tractu temporis invalescebant, sensisse; tandem (appellente usitato partus tempore,) ipsos parturientis labores subiisse, ut obstetricem accersere necesse habuerit. Sed non adfuit *Lucina*: attamen licet dolores illi evanuerint, haud detumuit venter; quin sæpius præ dolorum recursum obstetrix (quæ & ipsa, prout à nonnullis accepi, in eandem cum domina sua sententiam propenderat,) rursus accitata est. Ab eo tempore motum illum, sed vegetiorem se persensisse asseruit, adeo ut vestes frequenter attolli ab adstantibus conspectæ fuerint, tumore, licet aliquantulum, haud tamen impense aucto. Mammæ, quas & vidi & attrectavi, minime, prout vetulis solenne est, flaccidæ, sed amplæ & distentæ (at non supra modum,) glandulisque, more prægnantium, distinctæ. Mihi quinetiam sponte affirmavit, obstetricem sibi asseruisse orificium uteri internum æque tenerum & molle fuisse, ac in quavis fæmina mox paritura. Cum porro percontarer utrum inter decumbendum, cum à latere ad latus se reclinaret, pondus ab uno in alterum devolvi perciperet prorsus negavit, meque de mola nil suspicari iussit, cum illam peritius dignosceret, quam ut hac in parte decipi posset.

Cis paucos dies illam revisi, eademque, ut retuli, de novo narrantem audiavi, mammaeque in eodem statu comperi, ventrem vero aliquanto magis intumuisse, de cujus tensione plurimum conquesta est. Motus autem magis

gis, quam ante hac, vegetos se tum percipere dixit; atque ego, manu supra vestes admota, bis, dum pauculam illic moram facerem, ejusmodi motum nunc ex una nunc altera ventris parte sensi, qualem in vere prægnantibus observasse memini. Toto hoc gestationis (si ad ipsius mentem loqui liceat,) tempore nullum, saltem alicujus momenti, sanitatis dispendium passam se profitetur, nullis symptomatis laborasse, nisi quæ gravidis sunt familiaria, & quæ etiam, dum puerpera fuit, perpeti solebat. Cibos satis recte appetit, optimeque digerit: minime siticulosa est, prout hydropicis usus est, urinamque ad liquidorum assumptorum mensuram proportionatam reddit, ad morem autem gravidarum solito frequentius. Aedes hortumque satis valenter obambulat, nec baculi fulcimento indiget. Moderate dormit, sed petulca ventris sarcina matri suæ vix ultra diluculum quietem indulget, verum calcitratu cogit è lecto surgere; quo facto, & cibis assumptis, illa se iterum, somno parat, saltem mitius sævit. Quoad habitum corporis carnosus est, vultusque nil morbidus (me judice,) intus latentis præ se fert. Nullum tibiæ pedumve toto decursu unquam passa est tumorem, nec vulgatum ullum hydropis cujusunque, sive universalis, sive ipsius uteri, indicium, præter solum, quem dixi, abdominis tumorem colligere potui. Nec tamen sætum utero includi quisquam, nisi qui famæ suæ prodigus est, asseruerit; cum & ætas, & temporis à prima affectus invasione decursus longitudo (quorum neutrum cuiquam accidisse, præterquam quod *Saræ* pro miraculo obtigisse *Sacra Pagina* testatur, ulla, quod sciam, historia fide digna propalavit,) in tam absconam sententiam insurgant. Quicquid id est, *Illustrissime Heros*, haud fortassis abs re fore judicabit eximius ille vester arcani quantulicunque investigandi ardor, ut examen subeant tam inusitata phænomena, quod à limato judicio, quale tuum vere est, imprimis sperandum esset. Iter *Londinum* (marito nuper vita functo,) propediem meditatur, quod

supereſt vitæ apud filiam conſectura; ubi (cum appulerit,) ab ipſius ore, ſi locata opera dignum cenſueris, certior fi-
as; nec enim in tam frequenti, novitatis avida, urbe diu
latere poteſt. Interim boni conſulas, obteſtor, quod in
obſervantiæ reſſeram offert,

Honoratiſſime Domine,

Jan.

Favoris veſtri Cupientiſſimus,

28, 1671:

GULIELMUS COLE.

*Speraveram fore, ut ſi me ſuperſtite è vivis excederet
Spectabilis Domina, notitiam aliquam ex diſſectione, vel
propria inſpectione, vel aliorum communicatione, adipiſce-
rer, unde tam inſolita, maxime in proveſta adeo ætate, pro-
fluereſt accidentia. Verum didici tandem Dem, poſtquam
per duos vel tres annos Londini ſatis ſanam (cum eodem ta-
men tumore & motibus, licet non uſque adeo vegetis ac cum
ipſe inviſeram, literaſque iſtas exaraveram,) duxiſſet vi-
tam, fato ceſſiſſe; cumque inſtarent Celeb. aliquot Medici
ut cadaveris diſſecandi copia illis fieret, viri cuiuſdam ni-
mis pii ſuaſu id iis haud conceſſum eſſe.*

G. C.

A Letter from Mr. Nich. Waite Merchant of London, to Dr. Rob. Plot ; concerning some Incombustible Cloth, lately exposed to the Fire before the Royal Society.

Sir,

THE great respect and honour I bear to the learned and ingenious Gentlemen of the *Royal Society*, prevailed with me, within few days after my arrival in this *City*, to expose to their sight & examination a piece of *LinnenCloth*, which by their experiment consumed not in the *fire* : and you being then desirous I would give a short *narrative* of what *Substance*, and in what *parts* it is said to be made ; I here send you the same account I received of it, from one *Conco*, a natural *Chinese*, resident in the *City* of *Batavia* in the North-East parts of *India*. Who, by means of *Keay-arear Sukradana* (likewise a *Chinese*, and formerly chief *Customer* to the old *Sultan* of *Bantam*) did after several years diligence, procure, from a great *Mandarin* in *Lanquin* (a province of *China*,) near $\frac{3}{4}$ of a yard of the said *cloth* ; and declared that he was credibly informed, that the *Princes* of *Tartary*, and others adjoining to them, did use it in *burning* their *dead* ; and that it was said and believed by them, to be made of the under part of the *root* of a *tree* growing in the Province of *Sutan* ; and was supposed, in like manner, to be made of the *Todda* trees in *India* : and that, of the upper part of the said *root*, near the surface of the ground, was made a finer sort, which in three or four times burning I have seen diminish almost half : They report also, that out of the said *tree* there distills a *liquor*, which not consuming, is used with a *Wiek* made of the

same material with the *cloth*, to burn in their *Temples* to posterity. This, Sr, is the true *relation* I received of the nature and substance of it from the *Chinese* above mention'd; if as a *vegetable* it agree not with your Experiments or Judgment, your own commands obligeing me to render you this *account*, I hope there will not any ill construction be made there of, which is all the Favour is desired by

London,

Sept. 10th 1684.

Your most assured Humble

Servant NICH. WAITE.

The *Handkerchief* or pattern of this *Incombustible Linen*, which was shewn the *Royal Society*, (part whereof is engraven *Fig. 3.*) being measured, was found in length 9 Inches, between the *fringe* or *tassells*; the *fringe* at each end being 3 Inches more; so that the whole was just a foot in length; and the breadth was just $\frac{1}{2}$ a foot.

There were two *proofs* of its resisting *fire*; given at *London*: one, before some of the Members of the *R. Society*, privately, *Aug. 20. 1684*; when *Oyl* was permitted to be poured upon it whilst red hot, to enforce the violence of the fire: before it was put into the *fire* this first *trial*, it weighed one ounce, six drams, sixteen grains, and lost in the burning two drams, five grains.

The second *Experiment* of it was publick before the *Society*, *Nov. 12* following, when it weighed (as appears by the *Journal* of the *Society*) before it was put into the *fire*, one ounce, three drams, 18 grains. Being put into a clear *Charcoal fire*, it was permitted to continue red hot in it, for several minutes: when taken out (though red hot) it did not consume a piece of white *paper*, on which it was layd: it was presently cool, and upon weigh-
ing

ing it again, was found to have lost one dram, 6 grains.

Dec. 3, Mr. *Arthur Bayly*, one of the *Fellows* of the *R. Society*, presented them with a piece of this *Linnen* in the name of Mr. *Waite*. At the same time, the same Mr. *Bayly* presented Dr. *Plot* with another piece of it, which being brought to *Oxford* the *Experiment* was again repeated on it (*Dec. 16.*) it being put into a strong *Charcoal fire* in the *Natural History School*, in a full meeting of the *Philosophical Society* of that *University*; where after it had continued red hot for some considerable time, it was taken forth again little altered when cold, saving that it seemed a little *whiter* and *cleaner* than before it was put in; as appears upon the *Journal* of that *Society*. Concerning which, Dr. *Plot*, being desired to offer his thoughts, drew up the following *Discours*, which was read before the said *Society*, *June* the 23^d *An.* 1685.

A Discourse concerning the Incombustible Cloth above mentioned; Address't in a Letter to Mr. Arthur Bayly Merchant, and Fellow of the R. Society; and to Mr. Nicholas Waite, Merchant of London; by Rob. Plot. LL. D.

Worthy Gentlemen.

THE Historical account of the *incombustible Linnen Cloth* above mention'd, being sent me by the one of You; and a noble present made me of part of it by the other; with a desire from both, that I would search the old *Authors* and see how agreeable their *relations* are to this; give you Both a just right to the following *Discourse*: which I desire you would believe I address to you, not so much out of *Complement*, as true *gratitude* for so valuable

a gift. It being esteemed by the *Ancients*, though then more common, and perhaps better known, then 'tis yet amongst us, equally pretious with the best of Pearls^a.

Nor is it now of mean value even in the *Country* where made, a *China Cove*t, (i. e. a piece 23 inches and $\frac{3}{4}$ long,) being worth 80 *Tale* i. e. 36^{lb}. 13^s. 4^d. But that which much enhanced its worth with me, was, that hereby you put me in a capacity of giving full satisfaction to this famous *University* of the reality of the thing; whereof, I cannot blame them, if some did doubt; since we find very good *Authors* to have done the same: who though they owned such a mineral as *Amiantus*, out of the woolly part whereof this sort of *Linnen* was always anciently said to be made, yet questioned the possibility of its having been actually done: *Dalecampius* holding it very incredible, that it should be *woven into cloth*, by reason of its *brevity*^b; and *Schildius* in his *Commentary* upon *Suetonius* absolutely denying it, *Multi falso sibi Linteum quoddam arte ex ingenio suo comminiscuntur*, being his very words^c. *Xuerius Boxbornius* does not indeed deny but that there might be such *Linnen* amongst the *Indians*, where the *materials* of it grow; of which they might make them *funeral shrouds* wherein to enwrap the bodys of their *Princes* (as they say the ancient manner was) and so preserve their *Albes* distinct from those of the *Pyra* in which they were burnt: but he is peremptory that the Romans never used any such^d; and so is *Isaac Casaubon*^e. The truth whereof I shall not dispute: but whether they did or no, I am sure they might, had they pleased; for *Pliny* says expressly (and I dare believe him in any thing he speaks of his own knowledg) that he himself had seen *Napkins* thereof, which being taken *foul* from the board at a great feast, were cast into the *fire*, by which means they were better *scoured*, and looked *fairer* and *cleaner*, then

^a C. Plinii 211 Nat. Hist. Lib. 19. c. 1. ^b Jac. Dalecampii notæ in locum supra citat.
^c Joh. Schildij notæ in C. Suet. Tranq. Lib. 2. ^d M. Xuerii Boxbornii Quest. Rom. Quest.
 25. ^e Id. Casaub. notæ in Suet. Lib. 2. p. 186.

if they had been wash't in *water*^l. Now if they had such *Napkins*, they might no question have had *Sheets* of it too, and put them to the use above mention'd had they thought it expedient, as, 'tis said in the *Letter* above, the *Tartarian Princes*, and others adjoyning, doe at this very day.

That this *Linnen* was very well known to the *Ancients*, beside that of *Pliny*, we have the further testimony of *Cælius Rhodiginus*, who agrees with the *Letter*, placing both the *materials* and *manufacture* of it in *India*^g; and *Paulus Venetus* more particularly in *Tartary*, the *Emperour* whereof, he says, sent a piece of it to Pope *Alexander*^h. It is also mention'd by *Varro*; and *Turnebus* in his *Commentary* upon him, *de Lingua Lat*ⁱ. And by all of them as a thing inconsumable by fire. In these latter ages: *Geo. Agricola* tells us, that there was a *Mantle* of this *Linnen* at *Vereburg* in *Saxony*^k; and *Simon Majolus* says, he saw another of it at *Lovain* exposed to the fire^l. *Salmuth* also acquaints us that one *Podocattarus* a *Cyprian* Knight shewed it publickly at *Venice*, throwing it into the fire without scruple or hurt^m; and Mr. *Lassells* saw a piece of it in the curious *Cabinet* of *Manfred Septalla*, Canon of *Milan*ⁿ. Mr. *Ray* was shewed a purse of it by the Prince *Palatin* at *Heidleberg*, which he saw put into a pan of burning *Charcoal* till it was thoroughly ignite, which when taken out and cool, he could not perceive had receiv'd any harm^o; and we are told in the *Burgundian Philosophy*, of a long *Rope* of it, sent from *Signior Bocconi* to the *French King* & kept by Monsieur *Marchand* in the Kings gardens at *Paris*, which though steeped in *oyle* & put in the fire, is not consumed^p. To which add, that we have now seen a piece of this *Linnen*, pass the fiery triall both at

^g C. Plinii 2^{da}. Lib. 19. cap: 1. & Cæli Rhodigini Lectionum Antiq. Lib. 18. cap. 31. h. M. Pauli Veneti de Regionibus Orientalib. Lib. 1. cap. 47. i. Andr. Turnebi Comment. in Varr. de Lingua Lat. k. Geo. Agricola de natura Fossilium Lib. 5. l. Sim. Maioli dierum Canicul. part. 2. colloq 2^{da}. m. Hen Salmuth in Pandrolli rer. deperdit. Tit. 4. n. Rich. Lassells Voyage into Italy Part. 1. o. Ray's Observas. Topograph. &c. pap. 83. p. Philosoph. Burgund. Tom. 5. Tract. 3. cap. 5.

London, & Oxford. So that it seems to have been known in all ages, all describing it after the same manner, as a thing so insuperable by *fire*, that it only *cleanses* and makes it better.

It being clear then beyond controversy, that there always was, and now is such *incombustible Linnen*; it cannot but be worth while to consider it nicely, and in its full extent, which I shall doe first in giving some account of the notation of the *Names* of the *lanuginous mineral* of which 'tis made, and the *places* where found. 2. of its *natural principles*. 3. of the *manufacture* of it into *thread cloth*, &c. 4. of the variety of *uses* it has been put to. and 5. of the *reason* why *incombustible*. And of all these with as much brevity, as perspicuity will admit of. First then as to the *notation* of its *Names* whereof it has many, taken from its *qualities*, *colour*, *texture*, and *places* where found; It is called first (from its strange *qualities*) sometimes *Amiantus*, *quod in ignem injectus non mutatur*, the fire being so far from defileing it, that it rather gives it a *lustre*. 2. It is call'd *Asbestos*. and 3. *Salamandra*, in English *Salamanders wool*; I suppose from the *thryallides* or *Candle-Wicks* said to be anciently made of it, which being put into *Lamps* of such *inconsumable oyl*, as is mention'd in the *Letter*, would never waft, or goe out; which I take to be the true reason of the imposition of these *Names* upon it, whether there ever were any such *Lamps* or noe. For as for the stone *Asbestos* or *Apsyctos* mention'd by *Solinus*^q, *Ifodore*^r, *Salmasius*^t, and *Maiolus*^t, found in *Arcadia* of an *Iron-colour*, which they all say if once *heated*, can never be *extinguish't* or *cooled* again; it must be a quite different thing from *ours*, then which nothing is *extinguish't*, or *cooled* sooner. Nay so far is it from being the same with our *Asbestos*, that

^q Julii Solini Polyhist. Cap. 12. ^r Ifodor Episc. Hispal. Orig. Lib. 16. Cap. 4. ^t Cl. Salmasii Exercitat. Plin. in C. Jul. Solini Polyhist. ^t Sim. Maioli Colloq. Phys. admirand. Colloq. 18. & 22.

strictly speaking, I dare boldly say, there was never any such thing in *nature*: Notwithstanding what *Metaphrastes* tells us of it, relating to St. *George the Megalo-Martyr*, *Patron* of the *English*; who being condemned to be burnt by his wicked *persecutors*, that had seen many miracles done in the *name* of *Christ*, fearing the virtue of that *Name* might extinguish the *common fire*, *Asbesto lapide Sanctum obruerunt*, cover'd him all over with *Asbestos* stones which they thought could never be extinguish'd^u, For I guess with *Bollandus* it was nothing else but *Calx viva*^w; or *unslaked Lime*, which kept dry will indeed retain its fiery particles for a long season; or else some such stone as the *Apsytos* of *Pliny* which once heated will hold so for a week^x; like the *Ruggiola's* of *Spain* (which are broad plates, like tiles, cut out of a Mountain of red Salt near *Cardona*) that being heated on both sides will keep warm for a whole natural day^y; or our *Cornish* warming stone which will hold heat for 8 or 10 hours; All, or any of which, *per Synecdochen partis*, may in some sense be call'd *Asbestos* well enough. Yet *Isodore* and *Maïolus* both tell us of a *Lamp* that hung somewhere in a *Temple* of *Venus*, that had a wick of such *Asbestos*, that no tempest either of wind or water could possibly extinguish^z; and we are told that the *Lamp* found in the tomb of *Pallas* the *Arcadian* slain by *Turnus* in the *Trojan War*, was of this kind, it remaining *burning* after it was taken forth, notwithstanding either *wind* or *water*, with which some did endeavour to quench it^a. Which *Histories* must either be false, or the *Lamps* must have *Wicks* of some different kind of *Asbestos* from *ours*; which is easily *extinguish'd*; and from a *pungent* quality *Agricola* says it has on the tongue without *astringency*, is otherwise call'd *Alumen*^b, having the distinguishing Epithet [*plumeum*]

^u Sim. Metaphrastes in Encomio Sti. Georgii apud Lipoman. Tom. 7. in Apr. 23. ^w Bollandus in Acta Sanctorum. Apr. 23. 2. ^x C. Plinii 2^{da}. Nat. Hist. Lib. 37. cap. 10. ^y Fr. willoughby's Voyage through Spain. p. 471. ^z Isidor. Episc. Hispal. Orig. Lib. 16. cap. 4. & Sim. Maiolus colloq. Phys. admirand. colloq. 18. ^a Fortun. Liceti. de Lucern. Lib. cap. 11. ^b Geo. Agricola de Natura Fossilium Lib. 5.

added to it, taken from its downy filaments, to discriminate it from all the rest of the Alums.

From the *light gray* colour of its lanuginous parts, it is call'd by some *Polia*; by others *Corseides*; and from its likeness to the *hoary fibres* of some sort of *Matweed*, *Spartopolia*^c. From the capacity it has of being spun into thred, it is also call'd *Linum*, with some distinguishing *Epithet* taken either from its *quality*, such as *asbestinum*, or *vivum*^d; or from the place where found, in general or particular: it being call'd in general *Linum fossile*; in *English*, *Earth-flax* and in particular *Linum Indicum* by *Cælius Rhodiginus*^e; *Linum Creticum* by *Strabo*^f; *Linum Cyprium* by *Pancirollus*^g; also *Carpasum* by *Plutarch* and *Rhodiginus*, from *Carpasia* a City in *Cyprus*, near which it is found^h; and *Linum Carystium*, by *Pausanias* from a Town of that name in *Negropont* where it was also dugg^k. But beside these places that have given *Epithets* to the thred made of it, it is also found in *Tartary*, as *M. Paulus Venetus*^l and *Mr. Waite* agree; and as *Agricola* informs us, at *Namur* in the *Low-Countries*; at *Eisfeld* in *Thuringia*; amongst the mines in the old *Noricum*; somewhere in *Agypt*, and in the mountains of *Arcadia*^m; Also at *Puteoli* as *John Hessus* acquaintsⁿ; and lately in some mines in *Italy* by *Signior Marco Antonio Castagna*^o. To which we may add our own Country, it having been yet lately met with in a small *Island* belonging to *William Robinson Esq*; called *Ynis Molromadi*. e. the *Island of Sea-calves*, in the parish of *LLan-Fair yng Hornwy* in *Anglesey* in *Wales*.

Secondly as to the *natural principles* of it, though it be commonly by the *Lithographers* reckon'd among *stones*, I rather should judg it a *terra lapidosa* or middle substance

^c Ibidem. ^d C. Plinii 2^o. Nat. Hist. Lib. 19. cap. 1. ^e Cæl. Rhodigini Lect. antiq. Lib. 18. cap. 31. ^f Strabonis rer. Geograph. Lib. 10. ^g Guid. Pancirolli rer. deperdit. Tit. 4. ^h Cæl. Rhodigini Lect. Antiq. Lib. 14. cap. 18. ⁱ Vid. Geo. Agricolæ de Nat. Fossil. Lib. 5. ^j Mar. Pauli Venet. de Reg. on b. Oriental. Lib. 1. cap. 47. ^m Geo. Agricol. Ibid. ⁿ Pet. Andr. Matthioli Epist. Lib. 3. ^o philosoph. Transact. Numb. 166. 72.

between a stone and an earth; but whether the one or the other, made of a mixture (I guess) of some *Salt* or other, and a *pure earth* without *Sulphur*, coagulated in the *winter*, and harden'd to perfection by the heats in *Summer*. Which *Salt* *Johannes Hæssus* proves by a very cogent argument to be *Alumen liquidum*, describing it, as *Matthiolus* also does^p, to be a *whitish lacteous substance* somewhat inclining to *yellow*, that sweats out of the *earth*, and smells like *Rotten cheese*: whereof having gather'd a quantity at *Puteoli*, together with the other *Species's* of *Alum*, and kept it a while by him, when he came to look on it again, he found it to have lost the smell, and a great part of it changed into *Alumen Plumeum*^q: the *Saline* part (I suppose) shooting into *threads*, and the *pure earth* uniting them, as found in the places wherever generated: whether *sweating* from the *earth* as *Pliny* and *Matthiolus* would have it^r; or *percolated* through *rocks*, as we find it in *Wales*, the veins of it there running through a rock of stone in hardness and colour not unlike *flint*^t. And yet it seems to be made of much such an *Alum* as that of *John Hæssus* at *Puteoli* was, some of it being *straw-colour'd*, as if it still retain'd the *yellowness* that his *liquid bitumen* was said to have: which is a colour not given it by any *Author*, most of it being said to be *white* or *cineraceous*; some of it *red*; and some of an *Iron* colour as *Agri-cola* tells us^s; and I have some of the *Cyprian* by me sent from *Aleppo* by my worthy friend *Dr. Rob. Huntington* now *Provost* of *Trin. Coll. Dublin* whereof some is of a *light blew* or *pearl-colour*; and some of it ha's a cast of *Sea-green*. But however the whole mineral substances found at several places may differ in colour; yet I doe not find but the *woolly* part of them all seems to be much the same, *viz.* of a *white Silver* colour, the threads very *fine*

^p And. Matthioli Comment. in Lib. 5. Discor. cap. 82. ^q Andr. Matthioli Epistol. Lib. 3. ^r C. Plinii 2^o. Nat. Hist. Lib. 35. cap. 15. & Andr. Matthioli Comment. in Lib. 5. Discor. cap. 82. ^s Philosoph. Transact. Numb. 165. ^t Geo. Agricola de Nat. Fossil. L. 5.

and *slender*, yet very *ponderous*, the smallest particles of them thoroughly wet, sinking in *water*; as I also found a very slender thrumm of the *Incombustible Linnen* given me by Mr. *Baily*; which Mr. *Waite* brought from *India*, would also doe: which renders it very probable that it is not a *vegetable*, but a *mineral substance*, notwithstanding the informations of *Conco* and *Keay-arear Sukradana* mention'd in Mr. *Waite's* Letter. I say, renders it probable, there being several woods, such as *Box*, *red-wood*, *Persian wood*,^u &c. that will sink in water.

Concerning the *manufacture* of it into *thred*, *cloth*, &c. our *Letter* is silent, but *Marcus Paulus Venetus* very luckily supplies this defect, acquainting us in his book *de Regionibus Orientalibus*, how, it is made in *Tartary* it self: where he says it is found in a certain mountain in the province of *Chinchinthalas*, and made into *cloth*, as he was inform'd by one *Curficar* a *Turk* who was *Superintendent* of the *Mines* in that *Country*, after this manner. The *Lanuginous mineral* or *Amianthus* being first dryed in the *Sun*, is next pounded in a *brass mortar*, and the *earthy* part separated from the *woolly*, which is afterward *wash'd* from all filth whatever that may yet stick to it, and so, being thus purged, is then *spun* into *thred* like other *wool*, and after *wove* into *cloth*: which if *foul* or *spotted*, they cleanse, he says, by throwing it into the *fire* for an *hours* time, whence it will come forth unhurt, as white as *Snow*^w. Which very *Method* (as *Strabo* prescribes it) seems also to have been used in ordering the *Cretan Amiantus*, only with this addition, that after it was pounded, and the *earthy* part shook from the *wooly*, he says 'twas *comb'd*, and so does *Agricola*, which argues there was some of a greater length than any I have yet seen^x: what the *Cretan* might be I cannot tell, but the *Cyprian* I am sure is short enough, so is the *Welsh*, and so

^u Philosoph. Transact. Numb. 169. ^w Mar. Pauli Veneti de Regionibus Orientalibus Lib. 1. cap. 47. ^x Strabonis et Geograph. Lib. 10. & Geo. Agricolæ de Nat. Fossil. Lib. 5.

was all that was known in *Pliny's* time, who confesses it was very difficult to *weave* by reason of its *shortness*, *difficile textu propter brevitatem*: insomuch that I guess they used some *Art* to effect it, not discover'd by *Authors*, spinning it perhaps first together with *Tow*, and so weaving it into *cloth*, by which means 'tis likely it might hang together after twas *woven*, the *tow* being *burnt* away upon the first exposing it to the *fiery triall*; or else if they *spun* it alone, perhaps they might moisten it with *Gum-water*, or some other such *glutinous liquor*, to make it hang the better together, during the *spinning* and *working* it into *cloth*, which though burnt away upon the first *experiment*, yet the *Amiantus* once *woven*, in all probability might then hang together well enough of it self.

Thus having shewn the *Method* how *anciently*, and how possibly this *mineral* may be spun into *thred*, and consequently work't into *cloth* in our *Age*: let us next consider to what uses it ever was, or may be put. As to the former whereof *Pliny* informs us, that *Shrouds* of this *Linnen* were anciently used, at the *Royal Obsequies* of *K. K.* to wrap up their *Corps* in, so as that the *ashes* of their *bodies* might be preserved distinct from *those* of the *wood* which made the *funeral Pile*; and the *Letter* acquaints us that the *Princes* of *Tartary*, as *Teay-arear Sukradana* was credibly informed, doe use such at this day for *burning* their *dead*: which I have had so well confirmed from other hands since my receipt of that *Letter*, that I have little reason to doubt of the thing; there being no incapacity on the part of the *cloth*: of which though, as the *Letter* says, some is not so *good* as the rest (as 'tis in most other *commodities*) yet I doe not find there is any so *bad*, but will so far resist the *fire*, as to perform this *office*: for though it must be acknowledged it does *diminish* every time it un-

dergoes the violence of the *fire*; yet this hinders not but it may, and will, doe that *Service* divers times, before it be renderd altogether useles. *Cælius Calcagnanus* says that some of the *Ancients* made them *cloths* of it^a; with whom agrees *Turnebus* in his *Commentary* upon *Varro*^a; and *Cælius Rhodiginus* tells us indefinitely that the *Indians* did make them *Garments* of it^b; but *Hieracles* restrains it to the *Brachmans* only^c. The *Wicks* for the *Perpetual Lamps* of the *Ancients* were also made of *this*, as the same *Rhodiginus* further acquaints us; the *Wick* of the golden Lamp of *Callimachus* that hung in *Acropoli* being made (as he says)^d *Lino Carpasio*, of which the fire had no power^d. The *Emperor Constantin* also, as *Damasus* informs us, appointed a *Wick* to be made of this *incombustible flax*, which should perpetually burn in his *Baptistery* at *Rome*^e. And *Ludov. Vives* bears us Witness, that he saw many of these in Lamps, at *Paris*, that would never consume^h. That *Napkins*, *Mantles*, a *Purse* and *Rope* have been made of it, has been shewn already; and we are told that *Septalla*, *Canon* of *Millan* had thred, roaps, net-works, and Paper of itⁱ. *Marco Antonio Castagna*, who lately found this *mineral* somewhere in *Italy*, knows how to prepare, and render it so tractable and soft, that it resembles well enough a very fine *Lambs-Skin*, which he can thicken and make thin to what degree he please, and maketh it thereby, like either to a very *white Skin*, or a very *white Paper*^k. We have also made paper of our *Welsh Amiantus* but lately here at *Oxford*, which will bear both *fire* and *Ink* well enough, the *Ink* only turning *red* by the *violence* of the *fire*^l.

Lastly, to shew the *reason* whence it is, that this sub-

^a Cæli Calcagnini Epistol. Quæst. Lib. 3. Epist. 1. & Andr. Turnebi Comment. in Varr. de Lingua Lat. ^b Cæli Rhodigini Lectio. Antiq. Lib. 18. cap. 31. ^c Vid. Geo. Agricola de Nat. Foss. Lib. 5. ^d Cæli Rhodigini Lectio. Antiq. Lib. 14. cap. 18. ^e Damasc. in Sylvestr. pap. ^f Ludov. Vives in Scholio ad D. August. de Civitat. Dei. Lib. 21. cap. 6. ^g Museum Regalis Societat. Part. 3. chap. 5. ^h Philosoph. Transact. Numb. 72. ⁱ Philosoph. Transact. Numb. 166.

stance should be so strangely privileg'd by *nature*, as to be wholly put out of the *power* of *fire*: we must consider first (that we doe it with clearness) the *Qualities* and *power* of *fire* it self; 2. the condition of the *things* most lyable to *fire*; and then 3. what *things* they are that *resist* it most, and *remain* after it has exercis'd its ultimat force. The *qualities* then and *power* of *fire* according to *Aristotle* are, *Ἀσχηρὸν τὰ μὴ ὁμόφωνα, συσχηρὸν δὲ τὰ ὁμόφωνα* m, to *separat* things of a *different*, and *unite* those of a *like nature*. 2 The *Subjects* most apt to take *fire* and be dissolved by it, we find to be such *heterogeneous bodies*, in whose *pores* the most *Sulphureous bituminous*, and *aqueous particles* are lodg'd; which being seized by *fire*, are quickly put into motion, dilated, separated, and being thus made capable of flying away, are at last consumed; and dissolve the *frame* of those bodies whose *parts* before were *united* by them. When these are fled and gone, the *fire* naturally goes out, as having nothing now left to work upon, nothing remaining, but the *Salts* and *Earth* in the form of *Ashes*: which 3. in all sorts of compounds are the *things* that *resist* this *Element* most, and will remain after the most *exalted operation* it can be forced to. Nor doe the *Salts* only of *mixt bodies* thus baffle the force of *fire*, but the *simple ones* much more, as being more *homogeneous*, as we see in the *decrepitation* of *common Salt*, and *exsiccation* of *Vitriol*, which when the *aqueous parts* are once evaporated, are now a *pure simple homogeneous body*, no more *sensible* of the *fire*, the *decrepitation* ceasing, and nothing remaining that can be *dilated*, any further to break the *corns* of *Salt*. Now whatever the *fire* cannot *dilate*, it cannot *separate*, nor consequently *destroy*, or carry any thing from it, but what is *heterogeneous* and accidentally adhering to the outside of it: which is perfectly the case of our *incombustible Linnen*, whose *threads*

being altogether *homogeneous*, and nothing else but the *pure striæ* of liquid *Alum*, as was shewn above, holding nothing of *Sulphur*, *bitumen*, or *water*, or any thing that is different or *heterogeneous* to it self, that can be *dilated* or *separated*, it is in no possibility indeed of being *lyable* to the *fire*: which may indeed pass through it, as we see it does when 'tis made *red hot*, but can carry nothing from it; but such *accidental filth* as has been put upon it, or accrewed by useing.

And thus *Gentlemen* I have run through the several *branches* laid down above, according to the capacity of the *subject*, and my self; wherein if I have done well, you have your *desire*; if ill, you see I have not scrupled to hazard my *reputation*, to serve my *Friends*; so that I hope you will believe without a *Complement*, that I really am,

Your most humble

Servant, R. P.

Short Memoirs for the Natural Experimental History of Mineral Waters: by the Honourable Robert Boyle, Fellow of the Royal Society. London. 1684; Octavo.

THE Author divides this Tract into six Sections ; the first whereof is only introductory, wherein he tells us, that although the best warrant we can have for the use of any of these waters, is the long and sufficient Experience of their good and bad effects, yet since the advice of Physicians to their Patients in this case is a thing of so great consequence, the circumstances so many and so necessary to be considered, and since the Curiosity of men hath been little greater, then to inquire only what Colour the *Mineral water* will strike with Galls or Oaken leaves, and what Kind and Quantity of Salt will remain after evaporation ; upon these and such like considerations our *Honourable Author* hath thought fit to communicate these his *Memoirs* in order to a more full and Methodicall *History of Mineral waters* ; to the drawing up of which, he thinks these 3 following Observations necessary.

First that a man ought to take notice of those particulars that relate to it, whilst tis yet under ground, or in it's native receptacles.

Secondly to examine the properties and other qualities of it, when 'tis drawn up by men at the spring head or other receptacle.

Thirdly he is to consider the operation and Effects of it upon Humane bodies whether sick or sound, &c.

To the first of these he has subjoyn'd a set of Titles for

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the first part of the proposed work. He hath given likewise a Scheme of Titles for the second part: But because the second part is that which he mainly designed, he referr'd to it two other Sections *viz.* the fourth and fifth. In the first of which he gives Experimental Remarks upon the way of Examining *Mineral waters* by the help of Galls; the use of which he approves of rather in powder than infusion; but, for the more effectual course of either way, gives this caution, that the *Tincture* be not long drawn, nor the Galls themselves grown stale. He cannot by any means think Galls (or the Infusion thereof,) to be of that use and certainty, that it is Vagarily presum'd to have, in as much as it only discovers a liquor to be or not to be, either of a *Vitriolate* or *Ferrugineous* nature; for there are divers metalline Ores and other Mineral bodies which, not participating of Iron, will not by this means be discover'd, and yet may at the same time strongly impregnate the water proposed; the decoction of *Arsenic* for example, changes no more upon Galls, than would common water. Moreover unless Iron be the only predominant Mineral in the *Vitriolated* water, the infusion of Galls does not answer it, for upon a strong Solution of *Roman Vitriol* (where Copper is the only, or at least the predominant metal) the infusion, or Tincture of Galls afforded neither a black nor blackish colour, only a thick and muddy one, that was not so much as purplish. And though the *Author* be, for certain reasons unwilling to set down a way to discover in a trice both these *Vitriols* without any liquor or tangible body, yet he has been so candid as to subjoin as a *succedaneum*, the way of making a liquor that will presently turn black with a solution of *Martial* or *Cupreous Vitriol*.

In his fifth Section (consisting of Annotations and Notes on other Articles of the same second part) he observes, and brings his Ocular demonstration for the life

& motion of those creatures found in water wherein pepper has been infus'd. He observes likewise that the freshness and quickness of such *Ferruginous waters* as are lighter then common water, are much lost in the removal. Neither will the waters themselves have those Effects they would at the spring head, or before their removal. He dislikes the division of *Mineral waters* into *Acidulae* & *Thermæ*, having by several tryalls found, that there is not a manifest Acidity in those waters that are not Sulphureous or hot; supposing also, that they may in all probability have spent the Acidity they had, upon the Iron Ore, which they dissolv'd in their passages; neither does he think any of our purgative waters contain a Salt that belongs to any one known sort of Salts; but is either of a sort for which we have yet no name, or else is of a compounded Nature, since two bodies, neither of which is *Cathartick*, may by a change of texture compose a third body briskly purgative; of which he has given an Example; he adds that (as far as he has observ'd,) those *Ferruginous waters*, that are not heavier then common water, and in most drinkers prove but *Diuretick*, afford very little *Caput mortuum*, or dry substance, upon the total evaporation of their liquor; whereas *Mineral waters* that are purging, and manifestly more ponderous in *specie* then common water, leave a considerable Quantity of Residence. ex. gr. A pound of *Barnet* water (which is purgative,) yielded one dram of white powder. A pound of *Tunbridge* water yielded *Cap: mort.* about gr. i. Twenty five ounces of *German spaw* water gave but --- gr. iſſ. Neither need so small a Quantity seem inconsiderable, since upon tryall one part of *Marcasite* did communicate a Tincture to 61440 parts of the infusion of Galls; and upon Computation one grain of *Vitriolate* substance might impregnate 6000 times its weight of common water, so as to make it fit to produce with Galls a purple colour. To all which lastly is sub-

joyn'd the sixth Section, which the *Author* himself tells us, consists only of a set of Articles referable to the medicinal use of Mineral waters.

ERRATA.

P Ag. 1053. lin. 32. for *fiery* read *fiery*. lin. penult. for *pap.* read *pag.* pag. 1055. lin. 35. 'read [Apr. 23. cap. 2.] pag. 1056, lin. 23. read [acquaints us.] pag. 1060. lin. 16, after *Rome* add [To which add that *Joachimus Fortius* (vid. *Joach. Fortii Experiment : Lib.*) & *Jacobus Reckerus* (vid. *Iliius de Secretis Lib. 3. cap. 2.*) both affirm upon their own Experiment and knowledge that it may be formed into the likeness of a Wick, that will administer to the flame and not be wasted.]

*Printed at the Theater in Oxford, for Sam.
Smith at the Prince's Arms in Paul's Church-
yard London; and Hen. Clements
Book-seller in Oxford.*

F I N I S.

PHILOSOPHICAL

TRANSACTIONS.

July, 22d. 1685.

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Phænomena in Cadavere prænobilis cujusdam Fæminæ, Apoplexia peremptæ, inter dissecandum, Maii 12, 1679, à Clariss. Medico D^{no}. Dre. Cole Observata.

ILlustrissima D^r, in sæculi ornamentum & exemplum nata (utpote cujus non solum stupendæ animi dotes, sed & eximia virtus, cunctos queis innotuisse contigit, in admirationem, imo & venerationem rapuerunt,) à multis retro annis *hypochondriacis* (prout vulgo dicuntur,) & *hystericis* laboraverat symptomatis; quibus aliquoties, at nuperis annis, supervenerat narium hæmorrhagia, eaque quandoque tam profusa, ut de vita fere desperandum fuerit. Ad periculum & à morbis, & ab hæmorrhagia, averruncandum, phlebotomia (nescio ipsius D^æ, an medicorum suasu,) inter alia præsidia sæpe in subsidium vocata fuerat, à qua (non secus ac ab hæmorrhagiis dum moderate procederent,) egregium sæpenumero levamen, emaciatum quamvis fuit, & non morbo solum & jeuniis maceratum, corpus, sensit. Imo licet ante mensem, plus minus, ab obitu spontaneam, eamque valde copiosam, hæmorrhagiam, quæ negotio non omnino nullo tandem sistebatur, perpeffa fuerat, usque adeo tamen ab eo tempore in valetudine, paulo ante desperata fere, recuperanda promoverat, ut sibi persuaserat, se jam extra discriminis aleam, diminutis plurimum symptomatis, ferme constitisse. Solummodo pridie ejus diei, qui illi supremus erat, denuo ad hæmorrhagiam solitam proclivis erat, quam omni ope sub ipso erumpere gestientis sanguinis primo nixu prævenire satagebat, periculum, quod nuper ab immodico ejus effluxu evaserat, iterum verita. Et quidem nimis fataliter cessit remedium quæ adhibuit successus, sanguine non amplius prodeunte;

deunte ; unde se in tuto positam, vel eo ipso ante obitum die, Maii 10, censuit. Cum ex improvise fatalis illius immineret catastrophe. Postquam enim vespere intra cubile composuerat, subito immani capitis dolore correpta erat ; cuius gratia (vacillare statim incipiente lingua,) chirurgum extemplo advocari iussit, qui sanguinem detraheret. Ille autem, qui mille passus inde aberat, non ante appellere potuit, quam Nobilissima D^{na}. è vivis excesserat, quod intra semihoram ab insultu contigit.

Ad cadaveris apertionem vocatus, accito in operis societatem doctiss. D. *Tomkyns*, nil in visceribus abdomine contentis invenire potuimus, unde vel insignem aliquam labem iis adesse concluderemus, nedum mortis causam illic latitare. Et quidem, notatu dignum erat, quod quamvis à triginta annis jecur, ab omnibus fere Celeberr. Medicis, quos sanitati suæ moderandæ admoverat (& inter cæteros famigeratis. D. *Mayerne*,) non modo summe obstructum (quæ etiam de Liene pronuntiata fuerat sententia,) sed etiam scirrhosum habitum fuerat ; usque adeo tamen ab omni labe immune erat, ut nulla vel minimæ obstructionis, (licet ubicunque talem latitare suspicio ingruere potuit aperuerimus,) vestigia offendi potuerant ; verum vasa debitas suas distributiones quantum colligere potuimus, observabant, substantia uniformis & compacta erat, colorque universim, qualem naturæ modus exigit, optimus ; hinc ut appareat, quam injuste sæpenumero criminari soleamus hoc viscus. Solummodo prægrande erat, & proinde (in macilento præsertim corpore,) majorem solita in hypochondrio tensionem efficiens, palpum iis facile obtrudere potuit, qui, pro solenni olim more, cunctorum, *hypochondriacorum* titulo insignitorum, symptomatum causas ab Hepate & Liene obstructis deducunt. Hoc saltem notavimus, quod nec in cysti fellea, quæ plurimum contracta erat, nec in reliquis (quæ sese conspicienda obtule-

runt,) per hepar (parvis vasis biliaribus, quicquam bilis repertum fuerit, nec ab ea tincturam, nisi admodum dilutam, hauserant; verum in cystis cavitate quatuordecim reperiebantur concretiones, quarum maxima pars magnitudine pisa æquabant, duæ vel tres paulo ampliores erant, pressæ rotunditatis, exterius fere nigricantes, & glabræ, atque Bezoar, postquam paululum aeri expositæ fuerant, æmulantes, primo autem intuitu pilulas aloeticas referentes, intus flavescentes, cum aliquali in centro cavitate, facileque friabiles.

Lien pariter ab omni labe immunis videbatur, sed, non secus ac hepar, solito grandior.

Ventriculus vacuus (utpote quem pauculis ante mortem horis depleverat vomitionis, non infrequens toto ægritudinis decursu, paroxysmus; ut taceam Hon. Dⁿⁱ tantafemper, ne Seraphicis fruitionibus poneretur obex, abstinencia usum fuisse, ut raro ipsis naturæ indigentis, alimentorum debita ingesta mensura, vel maxime sana consuleret,) non multum, vel quod ad colorem vel texturam attinet, nisi quod paulo flaccidior fuerit, culpandus videbatur.

Pancreas nulla evidentia obstructionis indicia probebat, ut nec mesenterii glandulæ. Omentum satis firmum erat.

Renes & sabulo, & calculis, omnique obstruente materia liberi erant, quantumvis præ doloribus, qui circa eorum regionem aliquoties invadere solebant, crediderat aliquando Illustr. D^s, se calculo laborasse; Solum modo laxior aliquantum æquo videbatur illorum compages; quod forsan copiosæ quam perpeti solebat, urinæ limpidæ eos perluentis quantitati imputari mereatur.

Uterus debite constitutus videbatur, quamvis ex symptomatis, quibus antea laboraverat, haud pauca huic parti adscribi soleant.

Intra

Intra thoracem observandum occurrebat, 1^o, quod in dextro latere pulmones tam firmiter pleuræ, quatuor digitorum latitudine, adhærerent, ut nisi cultri adminiculo ægre separari potuerint; 2^o, quod variis in locis, præsertim hic illic circa loborum margines, tanto nigrore afficerentur, ut ad sphacelationes proni viderentur.

Cor sanum conspiciebatur: quodque forsitan attendi mereatur, pinguedinis sat magna quantitas basi ejus accrevit, quanquam reliquo corpore valde emaciata fuerit.

Aperto vero cranio tam subitæ cladis evidenter sese obtulit causa. Vasa etenim sanguifera membranas (*tenuem* præsertim,) dextri lobi cerebri perreptantia, sanguine admodum turgebant; iisque ex illa cerebri regione, (qua se laborare statim ab invasione conquesta est,) difficillimis, magna effluxit serosi sanguinis quantitas; quo evacuato, cerebrique substantia cultello aperta, sese in conspectum obtulit largus concreti cruoris grumus, qui stateræ impositus pependit unciam circiter cum dimidia, atque proinde largam illic sibi necessario formaverat cavitatem. Ast in ventriculos, vel alibi inter membranas nil omnino sanguinis effusum erat. Sinistrum lobum quod attinet, nec ille, nec ejus vasa sanguine supra modum turgebant. De cætero, nil in propria isthac, quam lucernarum ope adornabamus, dissectione (nempe festinandum erat,) comperire potuimus, unde concludendum esset cerebrum, quantum oculis patuit, male affectum esse; tametsi ex variis symptomatis quibus à longo tempore obnoxia fuisset Nobiliss. D^s (utpote cordis tremore, & palpitationibus, magnis anxietatibus, musculorum in artubus aliisque partibus contracturis & doloribus, aliisque pluribus convulsivis,) non levis momenti argumenta succi nervosi haud parum vitiati delumi potuerint. Unde corollarium isthoc forsitan deducere liceat; Succorum in corpore contentorum vitia non semper partium vel continentium vel

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secernentium culpæ, sed quandoque (si non plerumque,) propriæ eorum degenerationi & dyscrasiæ imputanda esse. Cerebrum, cum cerebello, cranio exemptum, & superfluo, qua licuit, sanguine liberatum, pependit *libi unt* XIII, juxta vulgata pondera quæ apud nos in usu sunt, & ad manum erant, *Averduois* dicta; id quod forsân curiosis non ingrâtum fuerit annotasse.

An abstract of a Letter from Mr. Leewenhoeck, to the R. S. dated Jan. 23d, 1684; Concerning the the Various Figures of the Salts contained in several substances.

I Took some of the Salt of *Carduus Benedictus*, such as is commonly to be sold in the Apothecary's shops: it was something moist, and the parts seem'd to be so huddled up together, that they could not be distinguished from one another: I closed it up in a Glass, that the moistness thereof might not be evaporated; and when it had stood stopt for some days, I perceived that many of the particles were gone together, upon the side of the Glass, making some flat longish figures, of different magnitudes; the biggest whereof, were about the length of the Diameter of a hair of my Beard, as Numb. 1. *Fig. F.* In another place, these Salts lay so, that I could easily discern their thickness, (which could not be done in the aforementioned) as *Fig. G.* In another place, the aforesaid thin flat Salts, lay upon one another; as *Fig. H.* I put this Salt in water to dissolve it, and took about as much thereof, as two Barly Corns; spreading it thin before me: and when it was in motion, I not only observed the above mentioned figures, and shootings of the Salt; but found severall new figures, which were thin and long, growing sharp towards both ends: as *Fig. L.* Others that lay near them were broader, but not so long, and their ends not so sharp: as *Fig. K.* I saw also, some perfect four square figures; as Numb. *L.* but they had no thickness, that I could discover. Also there were some Quadrilateral Pyramidal figures, like those of common Salt; as *Fig. M.* These Observations must be made before the water is evaporated, for when the water is

almost gone, such a multitude of particles appear, and run together, that they cause a confusion. After this I conferred with an Apothecary, about the making of the Salt of *Carduus Benedictus*; and he assured me, that almost all the shops make it of a mixture of the Stalks of divers herbs burnt; but he had a little that was true made, and fresh; some whereof I took, and found it to consist of irregular small and roundish particles: & every particle consisted again, of others that were roundish and less. Upon a further examination, I perceived very plainly, a number of figures tapering towards both ends, as is above mentioned, in *Fig. I.* After about a days time, I saw several flat figures; as *F* and *H.* But having dissolved the Salt in rain water, and viewed it as it lay thin upon my Plate, I found all the above mentioned figures; but those of *K, L,* and *M.* exceeded in number all the rest; In so much, that I conceived I saw more in a quantity of water equall to the weight of a Grain, then there are Stars to be seen in the Heaven by the naked Ey. All these figures as they were transparent, and very regular, as long as they had any water about them; so they were irregular, by the going together of other particles, as soon as the water was evaporated.

SALT of WORMWOOD.

I observed the Salt of *Wormwood*, such as is sold by the Apothecary's; but I found nothing remarkable: I then dissolved it in water, and therein presently discovered, a great quantity of figures, sharp at both ends; as numb. 2. *Fig. A.* Again there were lesser figures, as *B.* but they lay an innumerable company of them together: some few had six sides, as *C;* a few were flat and square, as *D.*

a very few were like Triangles, which had the Angles cut off; as *E*. Where the water had continued long, there were severall fix sided figures, as big as a small Sand; as among the rest *F*. Also some square pieces of Salt, like a looking Glafs with a Border about it, as *Fig. G*.

ALLUM.

I put some *Allum* in rain water, and observed therein very small figures, whose bases were Hexangular, the sides rising up Pyramidall, like a pointed Hexangular Diamond, as Numb. 3. *AAA*. They were of different magnitudes, and some seemed plain without any rising, as *BB*. There were also fix sided figures irregular, as *C* and *D*. But as the water began to be evaporated, there were made severall long blocks of *Allum*, as *Fig. E*. and the Salts run together as big as Sands, growing unmeasurably, where the water had been thickest, so, as thereby to be less distinct. I saw also, fix sided flat figures, as *F*. having in the middle, other small fix sided figures rising Pyramidally.

SALT-PETER.

I put *Salt-Peter* in water, and observed swimming in it, a few long particles, which seemed to have no thickness, as Numb. 4. *Fig. A*. These increased visibly in bigness, tho' I could not perceive any particles near them, that could cause it. As the water in any place began to be evaporated, I found many figures, whose basis was square, and rising into a Pyramid. There were also fi-

gures having but three sides ; but of these there were but few. Where the water lay thick, there were pretty figures like square sticks; as I have represented them in *CDE*. These last figures took up no greater space, then might have been covered with a great Sand ; tho' there were Clusters of them, that were a hundred times less. I have often pleased my self, in viewing these long square Crystalline sticks of *Salt-Peter* ; because of their lying huddled up together; as if they had been rayn'd out of the Sky.

VITRIOL of CYPRUS,

Or

BLEW VITRIOL.

Having dissolved blew *Vitriol of Cyprus* in fair rain water, and viewed it in a Microscope ; I found swimming upon the water, clear pellucid figures like Crystall ; these had no thickness to be discerned in them, because they were levell with the surface of the water ; all their ends were sloping, as Numb. 5. *Fig. A*. In two or three minutes of time, they grew a hundred times bigger then before ; though they continued to have the same shape : for they increased both in length and breadth ; but in becoming Bulky, they lost their pellucidness, and turn'd of a blew colour : other Salts were shorter, and shapt like *B*. I observed some of these so small, that by my Calculation, they were above eight and twenty thousand times thinner, then a hair of my head. As I spread the water very thin, the figures therein were so strange ; that it is not to be conceived : It seemed to me that the *Vitriol* separated from the water, and run into round particles ;
just

just like Oyl when it is mixt with water. As the forementioned figures past slowly, thro' a great deal of water, they increast gradually; as for example, a four sided figure was rais'd higher, by the gathering together of the *Vitriol*, which made a Border about it; and this not only once, but 15 or 16 times. In fine, it seem'd like a frame, whose mouldings were high rais'd, the ground or Basis, and the shape of the Circumference continuing still the same, as when the figure was little. These particles, and also the very small ones, I judge had a hollownes in them, and were not made in the body of the water, but upon the side of the Glafs, to which their basis stuck very fast.

SALT or OYL of TARTAR.

PER DELIQUIUM.

I mix't the liquor of *Tartar* with water, and let it stand for some time, that the grosser fowl parts might sink down. In this mixture I observed, that there were long slender particles, which thro' a common Microscope, were like the shavings of a Mans Beard; as Numb. 6. *Fig. A.* These drove against the superficies of the water; and some of them grew in length, bredth, and thickness as *Fig. B.* Also some as *Fig. C.* having many times two slope ends; but some had but one slope end; and the other end was sharp, as *Fig. D.* These Salts in some places grew so big, that through a Microscope, they seem'd as long as ones finger; But then they were odly made up,
and

and much more, when there were many of these great parts together, in a little space.

Of *MUSCOVY POT ASHES.*

I put *Muscovy Pot Ashes* in rain water, and after I had let it stand for some few hours, I observed in it longish figures, very like Weavers small *Shuttles*, as Numb. 7. *Fig. A.* These particles were so small, that I judged them, to be a thousand times thinner then a hair of my head; but as they became bigger, they grew to be like *Fig. B.* I saw also, a six sided figure, which rose Pyramidall, like a six sided pointed Diamond, as *Fig. C.* But this sort was very rare, as being scarce one to a thousand of the former. I saw also, severall figures which were oblong, and had four even or strait sides, as *Fig. D.* And some few, which were exactly square, as *Fig. E.*

After a days time, I put more *Pot Ashes* into the water, that the *Ly* might be the stronger, (and after that it had stood ten hours a clearing) there appeared in it, a very great number of extream small figures, which were four square like *E.* And also which were six sided, as *F.* But they were generally imperfect, and something long: these two last sorts, were each so small; (as were likewise the first of the forementioned figures; and some few shaped like *G.*) that they would not cover the  part of a course Sand. It was pleasant to see, (tho' my Eys were weary with long looking) that, what appeared at one time a clear Christalline water, would after a few minutes, be a great number of the above mentioned small

small figures ; which at first Glance, were scarce to be distinguished ; but of a sudden, they appeared very plain. When the *Ly* was thicker in one place then another, there came out so many different figures, having all their Dimensions ; that they were scarce to be reckoned : viz. four square, Oblong or Parallelogram, Cubical, Triangular, Hexangular, Rhomboidal, and divers others ; which had sometimes their thickness, equall to their length or breadth. As the aforesaid figures (tho' the *Ly* was but weak) were soon made in dry and clear weather ; so would they easily dissolve again into water, if the weather were damp : but when the weather was clear, or the water was any ways warmed, or was thin ; there were scarcely any other figures made, then such as are represented at *A*.

A Physician formerly complaind to me, that, tho' he applyed his Medicines with the greatest care imaginable ; yet sometimes, in one disease they would succeed well ; and at other times, in the same disease, but ill. I urged, that as one mans constitution is hotter then anothers, so the Salts in the Medicines, may proportionably to the heat of the body, alter their figure ; and not only so, but sometimes become more rigid and stiff.

I observed *Pot Ashes* made here in the Country ; likewise white *German Pot Ashes* ; also *Ashes* made of weeds ; but there was nothing remarkable in their Salts.

I observed *Pot Ashes* as they come to us, without putting any water to them ; and saw they consisted partly of a great many very small Salts, as Numb. 7. *Fig. A* and *D*. There were likewise many Salts, whose figures I could not describe, because of their confusedness, and their being mixt with Dust.

When the water wherein *Pot Ashes* was dissolved, had stood severall days, I saw swimming in it, many fix
P p fided

sided flat figures; as is represented *Fig. F.* Which still retained the same form, tho' the weather proved never so moist.

Of

CAMPHIR.

I observed some *Camphir* as it is brought from the *Indies*, and found at first nothing remarkable; but as I more narrowly searched into it, I perceived the Crystalline figures as they were clotted together. These figures, when they did not ly too close to one another, had six perfect sides; tho' they were of different magnitudes, they were generally longish; they had all their dimensions; and their thickness, was generally equall to their bredth; but their length, was more then their bredth; as *Fig. B.* Many of them, tho' they had six sides, were something irregular; some were shapt like the flint of a firelock; as *Fig. D.* tho' the most of the figures that I considered, were irregular; yet I judged, if they had not lain too close together, their form would have been like those of *Fig. A.* for when the parts of the *Camphir*, at first were small, and lay too close together, they might take from one another the means of increasing regularly every way; but when the parts are great, and come to apply their sides to one another; they then make very great and irregular Salts.

Salt

SALT of the *ASHES*
out of an Oven for the
FOUNDERY of *CANON*.

At, and above the Iron doors of the mouth of a Furnace, where *Canon* are cast, there sticks a white stuff like Ashes, which is made of the Metalline substances, together with the *Soot* rising out of the Furnace. I mixt some of this with water, and let it stand till the grosser parts were subsided, and the liquor was pretty clear, and then I observed therein, a very great number of small clear thin Pipes, so extremely slender, that I could hardly see them; when these Pipes were grown to about the bigness of the 25th part of a hair, the ends of them were stop't, as Numb. 9. *Fig. A.* Of these Salts there were severall thousands in one drop of water. There were likewise swimming about, a few particles as *Fig. B.* and tho' I could not discern the thickness in the first figures, yet in those last mentioned it was plain, that it was very little in comparison of the breadth: at another time there appeared to me Salts like *Fig. C.*

When I spread some of the above mentioned water, upon a clean glass, to make it ly more in one place then another, the water would not stick to the glass, but run together, as if it had been water shed upon an oily dish; or rather as if it self had been oyl; but it seemed to be most like blew *Vitriol* water. I remember, when I formerly took some of these Ashes, and dissolved them in water as now, there once appeared strange figures, made out of the Salts, resembling Plants with their roots and fibres.

SALT or *ASHES*
Of a
TIN or *LEAD OVEN.*

Our Porcellan Bakers use much *Tin*, or *Lead*, which they calcine in their Oven's. This work (which they continue 10 or 12 days together, that they may have a good quantity of materials by them, and not be forced to repeat the Operation 2 or 3 times a month) is so prejudicial to those that tend it, that a man can't stand before the mouth of the Oven, above 24 hours at a time, and then he looks as if he were poisoned: so that every day a fresh man is employed, to take care of the Oven, and remove the scum from the surface of the *Lead*. The consideration thereof, moved me to examine some of that grayish substance, which sticks to the stones, upon which the flame of the Oven beats, having dissolved it in water, and let it stand to settle, I found several oblong figures, as Numb. 10. *Fig. A.* they were of different magnitudes, and some bigger then *Fig. B.* some were sharp at both ends as *Fig. C.* All these, whether they swam in the water, or lay out of it, were generally without any discernable thickness, and were as transparent as the clearest water.

I particularly observed, that three figures, two of *C.* and one of *B.* lay in a quantity of water not so big as a Sand: while I caused some heat in this water, and continued to watch it, as imagining the other Salts therein contained, would increase the bulk of these three; I could find nothing but very small square Salts, whose sides rose up Pyramidally; these indeed grew bigger, but the others *C.* and *D.* were not altered: as the square Salts grew bigger, they became so much the more irregular,

lar, because the smaller Salts were driven upon them, or as it were attracted, for as they came near them, the foremost had as quick a motion, as if it were forceably impelled, till it united with them, making them more and more irregular; of such Salt particles, there lay 50 together, and as many more by themselves, being all made out of one drop of water.

From these observations I gather, that the aforesaid particles, were common Salt dispersed in the water, which could not be seen, till they united together, as the water was warm.

After an hour and half's time, I intended to view these Salts again; which I judged to be common Salt, but (tho' it were no rainy weather) I found them turned into fair water; I set then the drop of water again before me, and after about a quarter of an hours time, I saw not only a great many of the aforesaid Salt particles, but as they grew dry, a great many other very small particles lying round them, of a brown colour, appearing to the Ey like blackish, or musk coloured Sand; these I had no sooner removed into the open *Air*, (tho' there were no warmth come to them) but they presently disappeared, in less then $\frac{1}{10}$ of a minute, leaving neither water, nor any thing else in their place. Likewise the Salt particles, when they were little, were clear as Chrystall, but as they grew big, they seemd to be beset with musk-coloured parts, for they appeared brown, chiefly when the water was all evaporated. I then held the Salts before my mouth, and breathed upon them severall times, which changed them into a clear Chrystallin water; and by this means I had the pleasure, to see not only the Salts, but the musk-coloured parts, often come and go. These particles were many, and lay thick near the Salts, but further off thinner, and upon one breathing upon them vanished away.

In like manner, when the moisture of the *Ly* of Pot-

Asbes has exhaled, there has been made a very great number of small particles, which were of a brownish colour, but in a short time, they have not only lost their colour, but have disappeared, leaving behind them, a little thin moisture hardly to be perceived.

Further, I took at about 2 foot distance from the mouth of the *Tin*, and *Lead* Oven, out of the Chimney which the flame did not reach, a black substance like *Soot*, which I mingled with fair rain water, and let it stand till it was settled; in this water I observed there were made, many irregular figures, whose irregularity I believe proceeded, from the want of matter to perfect them, and from the too soon evaporating of the moisture; I saw likewise many neat, flat, transparent bodys, having each 4 corners sticking out, and 2 inward Angles, as Numb. 11. *Fig. A.* of this sort there were some that I could not see, but with my glasses that magnify most. There were also some figured like a Rhomb; and others like a Rhomboid, as at *Fig B.*

SALT in QUICK LIME

I put some of the *Quick Lime* that comes from *Liege*, into water, and observed therein, an exceeding great number of Salt particles, which were so very small, that I cannot attribute to them any perfect figure, but I judged, as much as the particles that incompassed them, would give me leave, that their sides that appeared to me, were square, and that their thickness, was near as much as their length: together with these, were some small figures sharp at both ends, as Numb. 12. *Fig. A.* Others blunt at both ends, as *Fig. B.* Others had six compleat sides, as *Fig. C.* and among these, some were so very small, that a Globule which makes the redness
of

of the blood, would cover them; these last were as transparent as the finest glass, & as thin as can be imagined; for if a piece of *Venice* paper, as large as the nail of ones thumb, were cut with six sides, the thickness thereof, to the breadth, would be more then it was in these figures: Nay when 5 or 6 of these particles lay disorderly upon one another, their thickness was inconsiderable. Also some few figures were shaped like *D* and *E*; some few like *F*: also there swam in the water, many flat thin particles, like a film or thin Skin; these (being viewed with my best Glasses) I judged to be made up of a number of very small salts like unto Sands; But the *Pot Ashes*, and other Salts; do in moist weather turn into a watery substance, yet the first sort above mentioned, and that having six sides, retained still their figures, tho' the place they lay in were wet; which wetness I believe proceeded partly, from the dissolution of some common Salt, (for I am perswaded, that not only in *Lime Stone*, but also in *Pot Ashes*, *Vitriol*, *Salt-Peter*, and almost all things, common Salt is to be found) and secondly from the moisture in the *Air* adhering to the Salts, as it usually does to close, and solid bodies.

SALT in LIME Of FISH SHELLS.

Of this *Lime* (which is made of *Sea Shells* burnt) I mixt a good quantity with water, and letting it stand till it was settled, I took up a drop, which seemed to be as clear as Chrystall; but I had no sooner observed it, then I perceived figures resembling thin boughs of a tree
without

without leaves; being so many in number, that they made the water white and troubled: these are composed of small Salts, and are difficult to be described; wherefore I have represented but one small one, Numb. 13. *Fig. A B C D E*; which takes up no more space, then that the breadth of it may be covered with a hair of ones head: the particles, whereof the branchy figures consisted, were six sided, and when they lay with the sides towards me, they seem'd to have a brownish shadow, which might be an effect of their bulkyness, and solidity; but when they lay with the edges towards me, they shew'd like *F*. some other figures had their upper part quadrilaterall; but others had the basis Quadrilateral, and the sides running up like a pointed Diamond, like common Salt. Others were like *I, K, L*, and *M*; which lying apart and separate from the rest, were more distinctly to be seen. Other figures were irregular, and could not well be described, because they were thick (as is before said) and cast a brown shadow about them. 2ly. because the sides of the Salt lay close, and joyned to one another. 3ly. because they were exceeding small.

After many Observations I am perswaded, the rise of these figures, is a thin plate of 6 or 4 sides, which continually increases in Bulk, as long as it swims in water that contains any Salt.

Among the innumerable quantity of small Salts, which are in a little water, there are some larger, and either transparent, or more obscure, of which last I shall describe 2 as *G* and *H*, which appeared plainly to be compounded of other figures, for in one of the sides of *G*, I counted more then 30 figures, which number being cubed, comes to about 30000: and yet the side of *G* seem'd not to be the 40th. part of the Diameter of a course Sand.

From hence may be learnt, the smallness of some Salts; as also of the particles that compound them, the
smart

Smart pain they cause in the body, and chiefly when a little lime gets into the Ey; the stiffness of this Salt above others; for tho' Salts made of the *Ashes* of *Plants*, are dissolved in a moist *Air*, yet the Salt of *Lime* remains unaltered, and without moisture, except it be caused by common Salt, which is in *Lime-stone*, as well as other things, and particularly in rain water, which I have often caught in the *Air*, and when it was evaporated, have found among the gross parts which remained, a common Salt which was hard, and fixt, as long as the weather was dry, but turn'd into a watery substance, as soon as it rained.

SALT of ENGLISH SODA

I took of this *Soda* (which is made of Glafs wort, and is much used by the Potters of our City, for the Glazing their Porcellan) and beat it small, and then put it into rain water; when it was settled, I observed in the water, long thin figures, whose ends I sometime thought to be streight lines, and other times circular, as Numb. 14. *Fig. A.* as the figures increased in bigness, I perceived them to be more strait at the ends, and not flat or plain, but generally raised, as *Fig. B.* Somewere raised, but their ends consisted of 3 sides; and some were even at one end, and had 3 sides at the other end as *C.* There were also 6 sided small figures, as *D.*; and of these I discovered a great number compleatly made, very thin and small, and clear as Chrystall; whereas the other figures were obscure, as if they had been strowed with blackish Sand; and so likewise were these, when they were viewed with a better Glafs.

I saw also figures which were broad in the Middle, and sharp at both ends; or rather a little flat as *E.* Also

Q q small

small squares as *F.* and this was the most generall figure of this Salt, for the bases were most of them square, running up into a Pyramid like common Salt.

I took some pains to find of what kind of parts *B, C, D,* and *E,* were compounded, and it seemed to me, that each of them consisted of parts like it self, yet I once observed that a six sided figure like *D.* had joyned it self to one like *E.*

When the water had layn long in the *Soda*, and was become very strong, there appeared in it, a great many transparent figures, like the fairest Chrystall; these had their sides perfect, were as thick as broad, and were shaped as *B, C,* and *D.*

SALT of SODA, Of *BRITANY.*

Having served the *Soda* as I did the *English*, I saw swimming in the water, an incredible number of small 6 sided figures, as Numb. 15. *Fig. A.* being very thin, and many of them so little, that I could not have described them, if some of them, had not been bigger then the rest. In another place, I saw great 6 sided planes, made like Hexagonall Looking Glasses, and having a small six sided figure upon the surface, as *B.* I saw also a few figures, formed like *C.* and some squares, as *D.* part whereof were plain, and others had the sides rising up Pyramidally into a point, as *E.* When I speak of the last Salts, that they run up into a point, it must not be understood that they are sharp at the top, but have the top or upper plain shaped like the Basis, tho' by
reason

reason of its littleness, it is not easily discerned: for example, if *E*. were magnified, till it appear as big as *F*. then would the top of *E*, not be sharp, but Quadrilaterall as at *F*, and like to the Basis: For the top is the true pattern of the Salt, and the rest of the bigness, is nothing but an addition of other quadrilaterall Salts: likewise would the top of *G*, if magnified, be like unto *H*.

SALT of ALICANT SODA.

I observed this *Soda* as the former, and at first observed little, but that there were swimming about, small figures representing withered branches of a Tree, composed of small particles, whose shape could not well be discerned: but after some days, the particles were grown so big, that I could see among them, flat thin 4 sided, and 6 sided figures, as Numb. 16. *Fig. A.* and *B.* Also oblong figures as *C.* whose sides run up sharp: these Salts were dissolved by the least moisture of the *Air*.

SAL ARMONIACK.

I have used much industry to see the figure of this Salt, but generally it appeared to me, (when it had been melted in water) like the Boughs of a Tree, beset with irregular leaves, one bigger then the other, as is represented Numb. 17. *Fig. AE.* In another place lay 5 or 6 Branches like *A*, seeming to proceed from a common center, as *E*. I saw also Salt particles like *B*, and *C*; and when I lighted upon a place where there were no
Q q 2
branches,

branches, the scattered Salts looked like so many flints, differing from one another in bigness, but being never perfectly round, as *Fig. D.*

P. S. *I have Anatomised another Bitch, which was said to have been lined 3 or 4 times, not 3 days before, and found in the Womb, a great number of living Animals, which are the Seed of the Dog, but will treat hereof more largely in my next.*

An Account of some Experiments for trying the force of great Guns, by the learned Mr. Greaves; communicated by Mr. Stubbs.

1651. Mar. 18. at Woolwich.

AT 200 yards distance from the platform for great Ordinance, there were raised 3 Butts, one behind another: the space between the first and the 2d butt was 14 yards, between the 2d and the 3d, eight. The thickness of each butt was 19 inches, whereof 13 was of beams of massy Oak fastened into the ground, and set so close that they touched each other: of each side were planks of Oke, 3 inches a piece in thickness, and these were joyned

joyned close, and fastned on both sides with iron bolts, and strong pins of wood, and on the back at the ends, and on the middle there were three braces of Elm, a foot in bredth, and 5 inches in thickness.

The first experiment was with an iron demy *Canon* of 3500 *lb* weight, the bullet 32 *lb* of iron, the powder 10 *lb*, which pierced through the 2 first butts, and stuck in the 3d, so as the ball was almost quite within, but the timber not shivered (small) nor scarce split. The butts being touched by me felt not warm; the like execution was done, when it was charged with 9 *lb*, as also when with 8 *lb* of powder.

This demy *Canon* was with a cylinder bore.

The 2d experiment was with an iron demy *Canon* having a taper bore, and being 3600 *lb* in weight, and 4 inches longer then the former, the iron bullet 32 *lb*, and the powder 7 *lb*, which in 3 trials seemed to have the same force with the first. One of the shots piercing through the 2d butt, and lighting near the edge of the middle butt of elm, tore it, but by the yielding of it, the bullet glanced aside off the 3d Butt, and entred into the earth.

The 3d experiment was with a whole *Culverin* in brass of 5300 *lb* in weight, 11 foot one inch in length, with a taper bore, being intended for a chace piece to the frigot called the *Speaker*; the iron bullet was 18 *lb* in weight; the powder in the first trial 10 *lb*, in the 2d 9 *lb*, in the 3d 8 *lb*: which last proportion did the best execution, and passed through the two first butts, entring gently into the 3d, which the former two did touch, but not enter.

The 4th, experiment was with a whole *Culverin* in brass made at *Amsterdam* for the *French* with this mark 3580 being 10 foot long, and not very thick in the breech, the first shot with 9 *lb* powder 18 *lb* bullet iron, past through the 3 butts, & entered one foot into the ground;

it past by the joynts of the timber, 2 planks having been beat down before. The 2d shot with 8*lb* powder past through 2 butts & grazed between them. The 3d with 8*lb* past 2 butts and 7 inches into the 3d, but the first butt was much battered before, where it entred. The 4th shot passed with 8*lb* powder, two butts, and in both butts through the midst of a maffy strong beam (below) that had not been battered.

The 5th experiment was with an iron Demy *Culverin* having 9*lb* bullet in iron, and 4*lb* powder, this past one butt (which was torn before) and entered the 2d.

This $\frac{1}{2}$ *Culverin* was shot 8 times, as fast as they could charge it with powder and the iron bullet, and yet was but scarce luke-warm at the breech, a little more in the midst, most at the muzzle, and this last scarce so hot as my hand, and yet the *Gunners* in charging her, wet not at all the scoop, or sponge.

The 6th experiment was with a brass demy *Culverin*; the breech of her was 13 inches $\frac{5}{8}$ (tried with a calaper compass;) the mouth 9 $\frac{1}{2}$. The first shot with 4*lb* powder; 9*lb* iron bullet, past 2 butts. The 2d shot with 3*lb* powder, past almost 2 butts: this proved to be the best shot, because the timbers were the strongest.

A new way of raising Water; by Dr. Papin, Fellow of the Royal Society.

HAVING seen it practised severall times, that after the Discovery of some new Problem, the Inventor propounds it as a Riddle, to stir up those that are ingenious in the same kind of learning, and make them find sometimes better things then what is propounded: I have thought I might do the same, with a way for *raising water*, which I think surely to be new, since it is not used in considerable occasions where it might be of great advantage.

AA. Is a great Glas made like a Tumbler, but much bigger, and laid upon the Chimney board *BB.*

CC. Is the Engine like a small Rock, that doth constantly spout out water by the two holes *DD*: this Rock is kept at a distance from the bottom of the Glas *AA*: so that it may plainly be seen that it cannot receive any water by subterranean Tubes.

EE. Is a factitious Corall reaching from the Center of the Rock *CC.* to the Center of the Crown *FF.*

FF. Is a Crown bearing upon the Aperture of the Glas *AA.* and holding the Rock *CC.* suspended at a considerable distance from the bottom.

GG. A Glas open at both ends applyed to the Rock *CC.* to keep the water upon it from falling down.

HH. Two shells to receive the water from the Jetto's.

I would have brought this Engine hither, but it is so apt to be spoiled, by carrying to and fro, that I hope the *R. S.* will pardon me, if I keep it at my lodging, where it may be seen at any time: and if they be pleased to appoint some that may come, and release one another, to watch it a whole day, and see whether it will not run constantly, nor loose any thing of its strength:

I hope that the learned in Hydrostaticks, being by these means assured of the possibility of such a Motion, will be the more ready to think of it, and find perhaps something better then this. But if no body doth it, I will my self within some months, publish this contrivance, with the uses it may be applied to.

According to the Inventors desire the *Royal Society* order'd that the thing should be observed: the Ingenious Mr. *Hook* saw it for near half an hour, there being other persons to observe it longer, who watch't it about four hours together, during which time there sprung out of the Rock *CC.* above a hundred times more water, then a vessel of the same bigness could hold: so that they went away not doubting but the water did circulate in the said Engin, and might continue a great deal longer, since it did run still as constantly and as high as at their first coming: and the Honorable Mr. *Boyl*, knowing the whole contrivance of the Engine, assures, that it may continue for a whole day and more; and thinks it worth to be left for some time, to the enquiry of Ingenious men.

A Treatise of Algebra, both Historical and Practical. By JOHN WALLIS, D. D. Professor of Geometry in the University of Oxford; and a Member of the Royal Society, London.

THE Author, in his Preface to the Reader, has given us a full account of this learned Work; which shall be here Reprinted in his own words.

It contains an Account of the Original, Progress, and Advancement of (what we now call) *Algebra*, from time to time; shewing its true Antiquity (as far as I have been able to trace it;) and by what Steps it hath attained to the Height at which now it is.

That it was in use of old among the *Grecians*, we need not doubt; but studiously concealed (by them) as a great Secret.

Examples we have of it in *Euclid*, at least in *Theo*, upon him; who ascribes the invention of it (amongst them) to *Plato*.

Other Examples we have of it in *Pappus*, and the effects of it in *Archimedes*, *Apollonius*, and others, though obscurely covered and disguised.

But we have no professed Treatise of it (among them) ancients than that of *Diophantus*, first published (in *Latin*) by *Xylander*, and since (in *Greek* and *Latin*) by *Bachetus*, with divers Additions of his own; and Re-printed lately with some Additions of Monsieur *Fermat*.

That it was of ancient use also among the *Arabs*, we have reason to believe, (and perhaps sooner than amongst the *Greeks*;) which they are supposed to have received (not from the *Greeks*, but) from the *Persians*, and these from the *Indians*.

From the *Arabs* (by means of the *Saracens* and *Moors*) it was brought into *Spain*, and thence into *England* (to-

gether with the use of the Numeral Figures, and other Parts of *Mathematical* Learning, and particularly the *Astronomical*,) before *Diophantus* seems to have been known amongst us: And from those we have the name of ALGEBRA.

And indeed most of the *Greek* Learning came to us the same way; the first Translations of *Euclid*, *Ptolemy*, and others, into *Latin*, being from the *Arabick* Copies, and not from the *Greek* Originals.

The use of the *Numeral* Figures (which we now have, but the *Greeks* had not) was a great advantage to the improvement of *Algebra*.

These Figures seem to have come in use, in these Parts, about the Eleventh Century (or rather in the Tenth Century, about the middle of it, if not sooner;) though some others think, not 'till about the middle of the Thirteenth; and it seems they did scarce come to be of common use 'till about that time.

Archimedes (in his *Arenarius*) had laid a good Foundation of such a way of Computation, (as he hath indeed, there and elsewhere, of most of those new Improvements, which later Ages have advanced;) Though he has not fitted a Notation thereunto.

The *Sexagesimal* Fractions (introduced, as it seems, by *Ptolemy*) did but imperfectly supply the want of such a Method of Numeral Figures.

The use of these Numeral Figures hath received two great Improvements. The one is that of Decimal Parts, which seems to have been introduced (silently and unobserved) by *Regiomontanus*, in his Trigonometrical Canons, about the Year 1450; but much advanced in the last and present Century, by *Simon Stevin*, and Mr. *Briggs*, &c.

And this is much to be preferred before *Ptolemy's* Sexagesimal way, as is shewed by the comparative use of both.

And therefore *Briggs*, *Gellibrand*, and others, have attempted the introducing of this, even in those cases
where

where the Sexagesimal is yet in use : Which doth in good measure, now obtain ; (and, daily more and more.) And would, no doubt, have obtained absolutely ere this time, did not the Old Tables heretofore Calculated, make it somewhat necessary to retain (in part) the Sexagesimal.

The other Improvement is that of *Logarithms*, which is of great use, especially in *Astronomical* and other *Trigonometrical* Calculations ; introduced by the Lord *Neper*, and perfected by Mr. *Briggs* (about the beginning of this Century.) The ground and practice of which is here declared.

And these things, though they be not properly Parts of *Algebra*, are yet of great advantage in the practice of it.

The first Printed Author which Treats of *Algebra* is *Lucas Pacciolus*, or *Lucas de Burgo*, a Minorite Fryer, of whom we have a Treatise in *Italian*, Printed at *Venice* in the Year 1494, (soon after the first Invention of Printing,) and Re-printed there, a while after.

But he therein mentions *Leonardus Pisanus*, and divers others more ancient than himself, from whom he Learned it ; but whose Works are not now extant.

This Fryer *Lucas*, in his *Summa Arithmetica & Geometrica*, (for he hath other Works extant) hath a very full Treatise of Arithmetick in all the parts of it ; in *Integers*, *Fractions*, *Surds*, *Binomials* ; Extraction of *Roots*, *Quadratick*, *Cubick*, &c. and the several Rules of *Proportion*, *Fellowship*, about *Accompts*, *Alligation*, and *False Position*, (so fully, that very little hath been thereunto added to this day :) And (after all this) of *Algebra*, with the Appurtenances thereunto, (as *Surd Roots*, *Negative Quantities*, *Binomials*, *Roots Universal*, the use of the Signs *Plus Minus*, or $+$ $-$, &c.) as far as *Quadratick Equations* reach, but no farther.

And this he tells us was derived from the *Arabs*, (to whom we are beholden for this kind of Learning,) without

taking notice of *Diophantus* (or any other *Greek* Author) who it seems was not known here in those days.

After him followed *Stiphelius* (a good Author,) and others by him cited, who also proceed no farther than *Quadratick* Equations.

Afterwards *Scipio Ferreus*, *Cardan*, *Tartalea*, and others, proceeded to the Solution of (some) *Cubick* Equations.

And *Bombelli* goes yet farther, and shews how to reduce a *Biquadratick* Equation (by the help of a *Cubick*) to two *Quadraticks*.

And *Nonnius* or *Nunnez* (in *Spanish*;) *Ramus*, *Schonerus*, *Salignacus*, *Clavius*, and others, (in *Latine*;) *Record*, *Digs*, and some others of our own, (in *English*;) did (in the last Century) pursue the same Subject, in different ways; but (for the most part) proceeded no farther than *Quadratick* Equations.

In the mean time, *Diophantus*, first by *Xylander* (in *Latin*) and afterwards by *Bachetus* (in *Greek* and *Latin*) was made publick; whose method differs much from that of the *Arabs* (whom those others followed,) and particularly in the order of denominating the Powers; as taking no notice of *Sursolids*, but using only the names of *Square* and *Cube*, with the Compounds of these.

And hitherto no other than the unknown Quantities were wont to be denoted in *Algebra* by particular Notes or Symbols; but, the known Quantities, by the ordinary Numeral Figures.

The next great step, for the improvement of *Algebra*, was that of *Specious Arithmetick*, first introduced by *Vieta* about the Year 1590.

This *Specious Arithmetick*, which gives Notes or Symbols (which he calls *Species*) to Quantities both known and unknown, doth (without altering the manner of demonstration, as to the substance,) furnish us with a short and convenient way of Notation; whereby the whole

whole process of many Operations is at once exposed to the Eye in a short Synopsis.

By help of this he makes many Discoveries, in the process of *Algebra*, not before taken notice of.

He introduceth also his Numeral *Exegesis*, of affected Equations, extracting the Roots of these in Numbers. Which had before been applied to single Equations, such as the extracting the Roots of *Squares*, *Cubes*, &c. singly proposed; but had not been applied (or but rarely) to Equations affected.

And in the Denomination of Powers, he follows the order of *Diophantus*; not that derived from the *Arabs*, which others had before used.

The method of *Vieta* is followed, and much improved, by Mr. *Oughtred* in his *Clavis* (first published in the Year 1631.) and other Treatises of his; and he doth therein, in a brief compendious method, declare in short, what had before been the Subject of large Volumes: and doth, in few small pieces of his, give us the Substance and marrow of all (or most of) the Ancient Geometry.

And for this reason, I have here inserted a pretty full account of his method, together with an Institution for the practice of *Algebra* according thereunto. And, though much of it had been before taught in the Authors above mentioned, yet this I judged the most proper place to insert such an Institution, because by him delivered in the most compendious form.

And in pursuance of his method, and as an Exemplification thereof, I have here added (beside some Examples of his own) a Discourse of *Angular Sections*, and several things thereon depending. But this (that it might not seem too great a Digression in the body of the Book) I have subjoined at the end as a Treatise by it self; as, for the like Reason, I have done some other things; to which the principal Treatise doth (in the proper places) refer.

Mr. *Harriot* was contemporary with Mr. *Oughtred*,
R r 3 (but

(but elder than he, and died before him,) and left many good things behind him in writing. Of which there is nothing hitherto made publick, but only his *Algebra* or *Analytice*, which was published by Mr. *Warner*, soon after that of Mr. *Oughtred*, in the same Year 1631.

He alters the way of Notation, used by *Vieta* and *Oughtred*, for another more convenient.

And he hath also made a strange improvement of *Algebra*, by discovering the true construction of *Compound Equations*, & how they may be raised by a Multiplication of *Simple Equations*, and may therefore be resolved into such.

By this means he shews the number of Roots (real or imaginary) in every Equation, and the Ingredients of all the Coefficients, in each degree of Affection.

He shews also how to increase or diminish the *Roots* (yet unknown) by any Excess, or in any Proportion assigned; to destroy some of the intermediate Terms; to turn Negative Roots into Affirmative, or these into those; with many other things very advantagious in the practice of *Algebra*.

And amongst other things, teacheth (thereby) to resolve, not only *Quadraticks*, but all *Cubick* Equations; even those whose Roots have, by others, been thought *Inexplicable*, and but *Imaginary*.

In sum, He hath taught (in a manner) all that which hath since passed for the *Cartesian* method of *Algebra*; there being scarce any thing of (pure) *Algebra* in *Des Cartes*, which was not before in *Harriot*; from whom *Des Cartes* seems to have taken what he hath (that is purely *Algebra*) but without naming him.

But the Application thereof to *Geometry*, or other particular Subjects, (which *Des Cartes* pursues,) is not the business of that Treatise of *Harriot*, (but what he hath handled in other Writings of his, which have not yet the good hap to be made publick;) the design of this being purely *Algebra*, abstract from particular Subjects.

Of

Of this treatise here is the fuller account inserted, because the Book it self hath been but little known abroad; that it may hence appear to what estate *Harriot* had brought *Algebra* before his death.

After this follows an account of Dr. *Pell's* method, who hath a particular way of Notation, by keeping a Register (in the Margin) of the severall Steps in his Demonstrations, with References from one to another.

Of this, some Examples are here inserted of his own, and others in imitation thereof; with intimation how that innumerable Solutions of Undetermined Cases are by his method easily discoverable, where great Mathematicians have thought it a great work to find out some one.

On this occasion there is a farther Discourse of *Undetermined Questions*, and the Limitation of them, and particularly of the Rule of *Alligation*; and of (what they call) *Geometrical Places*; which are of a like nature, and but the *Geometrical* Construction of (some of) these Undetermined Questions.

After this is a Discourse of *Negative Squares*, and the Roots of them; on which depend (what they call) *Imaginary Roots* of Impossible Equations; shewing, what is the true import thereof in nature, with divers Geometrical Constructions suiting thereunto.

And here also (though by way of Digression, as to the principal Subject) is account given of severall Geometrical Constructions, not only of *Quadratick*, but even of *Cubick* and *Biquadratick* Equations.

Then follows a Discourse of the method of *Exhaustions* (used by Ancients and Moderns,) with the foundation of it.

And in pursuance thereof, the *Geometria Indivisibilium* of *Cavalierius*; shewing the true import thereof, and its agreement with the Ancients method of Exhaustions; as being but a compendious Expression thereof,
and

and grounded thereupon; not any way contrary or repugnant thereunto.

Consequent to this, is the *Arithmetica Infinitorum*, which depends also on the method of Exhaustions; taking that to be Equal, which is proved to differ by less than any assignable Quantity. And a Vindication of the method of Demonstration therein used.

And lastly, the method of infinite *Series*, (as of late they have been called) or continual *Approximations*, (grounded on the same Principles;) arising Principally from *Division*, and Extraction of *Roots* in *Species*, Infinitely continued.

With several Examples of the Application thereof, to the Squaring of Curve-lined Figures, Rectifying of Curve Lines, Planing of Curve Surfaces, and many other perplexed Inquiries.

Which is an *Arithmetick of Infinites upon Infinites*. For when as the *Quotient* of Division, or the *Root* extracted in *Species*, doth not Terminate, but run on Infinitely, (much after the manner of some ordinary Fractions, when reduced to Decimals;) an Infinite Series of these (continued as far as is thought necessary,) is Collected according to the method, in the *Arithmetick of Infinites*, for Terminated Magnitudes.

This was introduced by Mr. *Isaac Newton*, and hath been pursued by Mr. *Nicholas Mercator*, and others.

And it is of great use for Rectifying of *Curve Lines*, Squaring of *Curve-lined Figures*, and other abstruse Difficulties in *Geometry*; especially where the Enquiry doth not end in a determinate Proportion, explicable according to the commonly received ways of Notation.

And on this occasion, is inserted a Discourse of *Infinite Progressions Geometrical*; (which when decreasing, become Equivalent to Finite Magnitudes,) first used by *Archimedes*, and since pursued by *Torricellius*, *San-Vincet*, *Tacquet*, and others. With the Result of two or more such Progressions compounded. Several

Several other Discourses are, partly inserted in their proper places, and partly subjoyned at the end, that they might not seem too great Digressions.

And particularly a Treatise of the *Cono-Cuneus* (a Body Compounded of a *Cone*, and a *Wedge*,) with the Sections thereof; considered in the same manner as the Sections of a *Cone* use to be considered.

A Treatise of *Angular Sections*, (a Subject handled by *Vieta*, and others,) with other things thereon depending; together with a short (but full) account of *Trigonometry*.

A further Treatise of the *Angle of Contact*; in pursuance of a former Treatise on that Subject. Wherein is further discoursed what concerns the *Composition of Magnitudes*, *Inceptives of Magnitudes*, *Composition of Motions*, and other things hereunto relating.

A Treatise of *Combinations*, *Alternations*, and *Aliquot Parts*: a Subject discoursed of, by *Schooten*, *Pell*, *Kersey*, and others.

With many other things, which may be seen in the Table of Chapters; but, more fully, in the Treatise it self. Much of which are Additions of my own, where I apprehended a defect (in what I met with in others) which seemed needfull to be supplied.

But I do not pretend so to have gleaned all those Authors who have Written on this Subject, as to have left nothing worthy to be there sought, in the Authors themselves, (especially as to the Accommodation thereof to particular Subjects:) But have rather directed to those Authors where such things are to be found.

And I have been the less able so to do (if I would have done it,) because I did not designedly read them over to this purpose, nor (when I did read them) did make Collections (as I went along) in order to such a design. But have rather (out of my memory) inserted (in their proper places) such things as the Order and Method of

the Discourse seemed to call for ; and (on such occasions) had recourse to the respective Authors.

Those who desire a fuller account of such things as I have but briefly touched ; may, for that purpose, consult *Vieta*, *Oughtred*, *Harriot*, *Cartes*, *Slusius*, and others; and (in English) Mr. *Kersey*; who hath published a Compleat Volume of *Algebra* (with the Appurtenances thereunto) in Two parts.

But my design being, to trace this of *Analyticks* (as the *Greeks* call'd it) or *Algebra* (as the *Arabs*) from its first Original (as near as I could) by the several Steps whereby it hath proceeded : Mine Ey was chiefly on the several Advances which from time to time it hath made; omitting, for the most part, the Accommodations thereof to particular Subjects.

And herein I have endeavoured, all along, to be just to every one : Ascribing, as near as I could, every Step of advance to its own Author; or at least to the most ancient of those in whom I found it.

If I have any where missed of this (ascribing to a latter what was due to some former Writer ;) it is either because I had not read the more ancient, or did not there heed it when I so read, or at least did not remember it, when I was Writing. And I shall be willing to be rectified, in what I have any where mistaken.

There may yet perhaps (notwithstanding all my care) be some difficulty to satisfy all Readers, as to what I have, or what I have not taken notice of. Who may think there are divers things omitted (and doubtless there are so) which might deserve to be taken notice of ; or but briefly touched, which might have deserved a fuller discourse ; and some things inserted, which (in their opinion) might have been spared, or needed not to have been so fully handled.

But as to such things, I must be content to leave my self to the Readers Candor ; or leave the Readers themselves

selves to fatisfie one another Amongst whom, some may be found to Blame, what another Commends, and some to Commend, what another Blames.

And I have endeavoured all along to represent the sentiments of others with Candor, and to the best advantage: Not Studiously seeking opportunities of Cavilling, or greedily catching at them if offered. (For there is no man can Write so warily, but that he may sometime give opportunity of Cavilling, to those who seek it.) And have been carefull to put the best Construction on their Words and Meaning; and, if need be (as sometimes there is) to help an incommodious expression, by one (as at least appeared to me) more intelligible and better agreeing (or more fully) to their own meaning; (without reproaching them for the want of such :) For it many times happens, that a man lights on a good notion; which he hath not the happiness to express so intelligibly, as perhaps another may do for him. And if here (sometimes) I have so done (as I think I have;) I do not therein wrong, either the Author or the Reader.

Apologia pro Circuitione Sanguinis; qua respondetur Æmylio Parisano, medico Veneto, Authore
 GEORGIO ENTIO; *Editio altera, auctior*
 & accuratior Lond. 1685. 8^{vo}.

THE Learned Author having thought fit to give us a second Edition of this Book, it may not be amiss to take notice of some particulars added in this Impression.

In his Epistle to Dr. *Harvey*, he shews how little truth there is in *Father Paul's* being the Inventor of the *Circulation*; for as much as the papers Written by him on this Subject, and found in his Study after his Death, were no

more then notes taken at the reading of Dr. *Harvey's* Book, which was lent him by a Country-man of his lately returned to *Venice* from *England*, where he had been *Ambassador* from that *State*, and was presented by the *Author* with one of these Books; the Truth of which appears from a Letter written by *Father Fulgentio* to Dr. *Harvey*, expressing as much.

In the Book it self he takes occasion to give some *Comparative* account of the *Spleen* in several creatures.

He enquires into the reason why the Air is hotter in Summer then in Winter, which he thinks does not proceed, from that the rays of the *Sun* fall on the Earth, nearer to a perpendicular, in the former then in the latter season; the *Angulus Incidentiæ* made by the Rays not being to be considered so much as the *number* of them; he supposes this effect may more rationally be deduced partly from the Northern Winds blowing much in Winter, but chiefly from the *Density* of the *Air* which defends us from the *Sun*, and prevails more (he thinks) by 40 to one, in the Winter, then in the Summer.

To prove that the Blood does not nourish, he urges the disproportion between some parts, and the quantity of Blood conveyd to them; thus a great deal of Blood is carryed to the Intestines, and but little to the Head, in proportion to the bigness of each part: he urges the largeness of the Veins in respect to the Arterys: and the smallness of the recruit the Blood receives by the *Ductus Thoracicus*, not large enough, the Author thinks, to convey matter for the nourishment of the whole body; with several other particulars to the same effect.

He answers the arguments of Dr. *Needham*, and Dr. *Mayow*, against the *Biolychnium*.

Printed at the Theater in Oxford, for Sam. Smith at the Prince's Arms in St. Paul's Church-yard London; and Hen. Clements Book-seller in Oxford.

PHILOSOPHICAL

TRANSACTIONS.

August 22d. 1685.

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An answer to some Quæries proposed by Mr. William Molyneux, concerning Lough-Neagh: by Mr. Edward Smyth, Fellow of Trinity Colledge in Dublin.

1. **W** *Hether Lough-Neagh hath really the quality of petrifying Wood?* To this I answer, that no experiment, or observation yet made, (that I can hear of) can prove the *Lough* has this petrifying quality; or that the water do's any way help or promote the petrification; for that two experiments made by a Gentleman of worth and good credit (whose Estate lies contiguous to the *Lough*, and whose curiositie prompted him to a more diligent search into this matter) plainly prove the contrary. For about 19 years ago, he stuck two *Holly-Stakes* (a wood which all agree will soonest petrifie in this *Lough*) in two severall places of the *Lough*, near that place where the upper *Band* enters into it; and that part of the stake, which for so long time has been washed by the water, remains there without any alteration, or the least advance towards petrification; as for that part of the stake which is covered by the mud or earth, he has not yet looked on it, but promises to do it this Summer, taking advantage of the fall of the *Lough*, and that too, which report make's the weakest, and most unfit for this operation, may seem not to conclude universally of the whole *Lough*; yet are a reasonable cause of doubting that, which ought to be, yet never was backed by any faithfull experiment; and I therefore believe it fabulous; for that had the *Lough* any such Vertue, it would most probably be diffus'd in some measure through the whole. This is true of those *Lakes* whose peculiarities are related by *Varenius*; and this seems evident

vident from the very nature of liquid bodies; for the parts of all liquid bodies being in a constant motion, and mixing with one another, any Vertue received in one part, must necessarily be diffus'd through the whole, at least in some degree, but the stakes in this experiment had not suffered the least alteration last Summer, though they had been almost three times seven years in the water.

2. *Whether this Qualitie be equally diffus'd throughout the whole Lough, or be more strong in any particular parts thereof?* Because there have been no certain experiments made upon all parts of the *Lough*, and much time required to make this tryall we cannot expect a speedy resolution of this *Quæry*; Report for the West side, and Dr. *Boat* (an Author for whose fidelity I vouch not) in his *Natural History of Ireland*, tells us that as his Brother informed him, who lived in those parts, that water has especially this Virtu about those places, where the *Black* water discharges it self into the Lake, but confesses he never could find any person who himselve had made the tryall, and therefore had this information from report, or some other way equally uncertain: so that there is still good reason to believe the water is wholly destitute of this petrifying qualitie.

3. *What woods are petrified by the Lough? or whether only Holly.* That not only *Holly*, but also *Oak*, and some other wood has been petrified about this *Lough*, and in the soil adjacent, I have sufficient grounds to conjecture on this account; because some Fishermen, being tenants of a gentleman from whom I had this relation, told him, they had found buried in the mud of this *Lough* great trees, with all their roots and branches petrified; and some of that bigness, that they believ'd they could scarcely be drawn by a team of Oxen. They broke off severall branches as big as a mans legg, and many bigger, but could not move the great trunk. If we may credit this relation, we must allow some other

woods to be petrified beside *Holly*, for *Holly* never grows to that bigness; the largest trees being scarcely by a third part so big; so that allowing for the unexactness and unfaithfulness of the Fishermens relation; we have grounds to believe this wood was other then *Holly*; my cheit reason for guessing it *Oak* is the bulk; no trees in that country, these excepted, growing to that prodigious bigness; besides there is much timber found in the mud on sand on the banks, such as Deal, &c. but no *Oak*, so that I believe what *Oak* was undermined by the water, was covered with mud, and so petrified into Stone, and of this sort might that be which the Fishermen found; for if some part of that ground which is now covered by the water, was formerly wood, as is on good grounds believed by those that live therabouts, as it is probable there was much *Oak* in the wood, so it is probable there is much buried in the *Lough*; Deal, and other trees are found here without any alteration, but what they might suffer in any other water.

4. *Whether the wood or Holly, brought from other places, be as apt to be petrified, as what grows in the grounds adjacent to the Lough?* If, as I shall make out in my answer to the last Quæry, this vertue of petrifying does certainly, if not solely reside in the soil contiguous to this *Lough*, most certainly trees that imbibe some of this petrifying Vertue, or these Lapideous particles with their nourishment, as being already dispos'd for it, will be more easily altered into stone.

5. *What time is requisite to petrifie a piece of a determinate bigness,* I heard of no experiment which can resolve this Quæry, but what report tells us of seven years is certainly a fable as to the water, I know of no body who has made tryall of the soil.

6. *Whether any has seen the same body partly wood and partly Stone?* I was informed by two Gentlemen of the North, that this may be frequently seen, who alledged they

they themselves had seen the same body, wood, and stone. But the only reason for thinking so, being the diversity of colours which might well enough proceed from severall degrees of petrification, we may probably think them deceived: for they made no experiments on that part which they reputed wood. They further told me that part of the body which touched the surface of the water was the partition between the petrified and unpetrified part of it; this further confirms me, they were impos'd on. This stone had been often found one part of it rotten and petrified, the other remaining firm and usefull: but this it has common with other stones: whether it became rotten in the wood, or stone, may be doubted.

7. *Whether the Bark has been seen petrified, as well as the Wood?* The *Bark* is never found petrified, as I am informed by a diligent Inquirer, but often something rotten about the stone answerable to the *Bark*.

8. *Whether any one has certainly made experiment of the Loughs petrifying, by putting a piece of wood therein, and there letting it ly till it was petrified?* Several pieces of *Holly* have been put into the *Lough*, but none, that I ever heard of, was ever taken out in any wise altered.

9. *Whether there be any Sand-pits nigh about the Lough in which these pieces of wood (we esteem petrified) are found?* I never could hear of any such Sand-pits, nor that this petrifying Vertue was stronger in any such places; there is a greater quantity of these stones found in the adjacent ground, and when ground is newly broke, ordinarily turned up in plowing.

10. *Whether the Earth, or Sand about this Lough be indued with this Qualitie?* That this Vertue is certainly, if not only, in the ground or soil I judge for these reasons, that there are many stones turned up daily especially at their breaking up new ground; which we cannot in any probabilitie think were brought thither; they are often

found at two miles distance from the *Lough*, seldom further, in great numbers, and very deep in the ground; now for what use and reason they should be brought thither I can't imagine: but because there may be exceptions against this reason I shall produce another; which I believe will plainly prove this assertion, it being matter of fact. The Gentleman on whose credit I received this information, had occasion one day to survey a part of his own land, and at a small distance from the *Lough*, he saw a stump of a tree just digged out of the ground, which by handling of it he found petrified; his Servant that digged it up, standing by him, told him he had just rooted it out of the ground: he assured me the roots and all were stone, and altogether like those stones that are ordinarily found and go by the name of *Lough-Neagh* stones. This certainly proves the soil to have this petrifying Vertue, which was never yet proved of the water. This Gentleman was of opinion these were *Lapidés sui generis*, till this observation convinced him: and I believe the wood, which I before mentioned that was found by the Fishermen *petrified*, owes its petrification to the soil and not to the water. But that these stones were once wood is I think very certain, for they shew the plain *vestigia* of wood, they likewise burn, cleave; filings of this stone thrown in the fire emitt a fragrant smell: they cut kindly with a knife, though not so easily, as other wood: but had they none of these properties, the instance now alledged, I think, is as convincing as Demonstration.

*Historiæ Convulsionum Periodicarum per Clariss.
D^{num} Gui. Cole, Med. Doct. descriptæ, & com-
municatæ.*

Convulsionis quintanam observantis periodum.

Febres intermittentes minorum gentium (Quotidianas scil. Tertianas & Quartanas) ubivis pullulasce-
re nimis omnes confici sumus; & quamvis earum causæ
in puteo lateant, de typis tamen sat superque omnibus
constat. Quintanarum autem, sextanarum, &c. quæ
longius protelatas agnoscunt periodos, quanquam inter
autores habeatur mentio, tam raro tamen in praxi oc-
currunt, ut raro Medicum convenerim, cui talem ali-
quam vidisse contigit. Mihi quidem ante quadriennium
obvenit taliter ægrotans (si modo à periodorum ratione
liceat Febrem denominare, ubi non insignis aderat ca-
lor, sed nervosi potissimum generis affecti signa) cujus Hi-
storiam, quantum suggerit memoria, describam.

Acri erat & lepidio ingenio, cujus casum refero, Do-
mina, formosa, *δωρὴς*, interque negotia domestica, quæ
continuo eam exercitam detinuerunt, plurimum occu-
pata, unde integra per multos annos valetudine potita
est, plures licet enixa fuisset liberos. Ante sexennium
vero abhinc prægnans, circa medium gestationis tempus,
in hystericos (nescio qua *αεφύσση*) incidit affectus, qui,
quamvis illo tempore remediis cedebant, subinde ta-
men recurrebant, licet non admodum frequentes. Tan-
dem instante partus tempore, postquam magis quam par
erat (gravi id postulante occasione) sese exercuerat, po-
stridie (accelerato forsan aliquantulum partus tempore)
cum maximis doloribus parturire cæpit, magna effluente
sanguinis quantitate, fætu tamen nondum in lucem e-
misso; donec labantibus viribus, totoque fere, prout

astantibus visum erat, excreto sanguine, de vita desperatum fuerit. In vitam vero quasi revocata (fætu tandem, sed mortuo, excluso) brevi in convulsivos incidit affectus, qui, non obstante remediorum usu, pertinaciter affligebant, per intervalla licet, ad plures menses, Inde aliquanto melius habuit, licet non in totum à præfatis symptomatis immunis; quæ tandem aucta, non incertis, ut ante, invasionibus molesta erant, sed primo tertianis, si recte teneo, periodis, dein quartanis, & non ita multo post quintanis (h. e. ut quatuor integri dies intercederent inter singulorum paroxysmorum initia) invadebant; idque exacte adeo, ut non certius horologiorum indices ad notatas figuras redeant, quam isti paroxysmi suos repeterent cursus. Incipiebant cum oscitatione, aliquali vigore, & magna urinæ limpidæ quantitate exclusa; dein ægrotans statim convulsa opus habuit ut astantium manibus prehenderentur ejus manus, secus vel vestes vel faciem dilacerabat, multoque nisu dentibus petebat prehendentium manus, mente omnino capta, & aphona. Postquam per horam unam vel alteram hoc modo convulsa perstitisset, urinæ limpidæ magna copia identidem reddita, sensim evanuit paroxysmus, obrepente somno, qui per plures horas perseverabat; tandemque, omnium quæ in paroxysmo transacta erant nescia, ad se rediit. Reliquis tribus diebus quamvis à paroxysmo libera, admodum tamen debilis & enervata erat, ut vix è lecto vel sedili surgere, nedum cameram obambulare absque ministrantium satellitio, potuerit.

Curacionem accersitus aggressus sum medicamentis testaceis. & sp. C. Cervi; indicationem sumens à magna illa urinæ profusione, & nervosi generis affectibus, quæ insignem & sanguini, & succo nervoso, acorem impressum fuisse mihi fidem fecerunt. Verum cum pertinaciter, his non obstantibus, hærent paroxysmi, statisque redirent periodis, in mentem venit, istos non aliter tractandos,

standos, quam solent febrium intermittentium. Quamvis enim non tantum præ se ferrent calorem, quantum febres vulgares intermittentes; cum tamen regulariter adeo, uti mos est istiusmodi febrium, procederent, cumque insuper non omnes intermittentes, proprie sic dictæ, eundem observant caloris modum, omnes tamen eodem remedio, Cortice sc. Peruviano, debellentur; statui famosissimo illo specifico hunc affectum aggredi (intercalatis tamen medicamentis supra memoratis, utpote quoniam alte mihi insederat notio dicta de acida succorum dyscrasia;) Nec fefellit eventus: Postquam enim duas vel tres istius corticis doses ante totidem paroxysmos, pro more tunc temporis (mihi saltem) solenni, exhibueram, sensibilibiter ferociam suam deposuerunt, tandem continuata ejusdem exhibitione prorsus evanuerunt, nec, quantum mihi rescisse contigit, postmodum redierunt.

Historia Convulsivi Affectus octonariam periodum à multis annis observantis, per Clariss. D^{num}. Gui. Cole, M. D. descripta & communicata.

Dorothea Cook vidua, sexagenaria, Coffepola Vigorniensis, a triginta sex annis (triduo post nuptias) Epilepticis, nulla notabili ~~methodo~~ corripit coepit; qui quamvis sub morbi initium frequenter, nullo tamen ordine, recurrebant. Invasio tam subita erat, ut quæ & aliis & sibi perfecte sana videbatur, noctu oculi in hu-

num, mente protinus orba, concidere solet: quo in statu postquam velut exanimis, nullis agitata convulsio- nibus, per aliquot horæ minuta jacuerat, discussa tan- dem nebula ad se rediit. Aliquot post menses circa ple- nilunium & novilunium, imo sæpius in die istis tempori- bus, invadebant paroxysmi, & ad duos vel tres dies recur- rere perseverabant; reliquo interlunii tempore bene ha- buit. Post pauculos inde menses, qui prius duarum fere septimanarum observaverant periodum, tandem bis in- tra singulas, sed inæqualiter æquali distantia, diebus sc. Jovis & Saturni, cursus suos repetebant. Brevi post nup- tias gravis facta est, foetumque solito tempore peperit, qui non ita multo post Epilepticus fato functus est; se- cundus item partus eodem modo periit: sed licet plures postmodum utriusque sexus liberos enixa fuerit, nullus tamen eorum ad hunc usque diem vel minimum ejusmodi effectus insultum perpeffus est.

Per tres circiter annos memorato ordine (variis licet tentatis remediis) invadere persistebant paroxysmi, do- nec tandem Empirici cujusdam plurimum decantato, nescio quo, remedio disparuerint, nec per aliquot menses redierunt; usque dum novi terroris occasione (ante po- tius, ut videtur, sopiti quam perfanati) recruduerint. Hinc ad idem remedium iterum confugiebat: sed quod pridem tantopere profuerat, nunc nil levaminis attulit. Nihilominus secunda vice doctissimi, perque multos an- nos apud *Vigorniam* merito celeberrimi, D. *Johnson* nu- per defuncti) ope à morbo brevi convaleuit, atque sana perstitit adusque famosum *Vigornienſe* prælium, anno 1651 dimicatum; quando, capta à *Cromwellio Vigornia*, dum ubique mors & horror læviebant, ipsa (non secus ac cuncti præterea incolæ) immani terrore perculsa, pri- stinorum insultum paroxysmorum iterum subiit; qui ex- inde irregulariter primo, & frequenter invadebant, postea sensim ad veterem redibant periodum. Dehinc varia, & à præfato D. *Johnson*, & ab aliis, usurpavit re- media,

media, sed incassum omnia. Postquam per biennium inde typo isthoc recurrere perstiterant, tandem præ consternatione iterata diem invasionis mutarunt, atque primum bis hebdomadatim, tandem sola die *Dominica* (commotionis ansa isthoc die forte-fortuna ablata) ad hoc usque tempus invaserunt. Cujus quidem periodi, & symptomatum progressus sequenti modo se à tot annis habet.

Die Jovis circa vesperam invadere incipit dolor in vertice, nec non pulsativus circa ossis sacri regionem, qui die Veneris, altius paulatim serpens, medium occupat dorsum: Vesperi diei Saturni immanior evadit (multum etiam urgente fiti) & pauculis, postquam se in lecto composuerit, horis ad humeros usque, sensim auctus assurgit; quo ubi pertigerit, quæ prius interdum domestica obire valuerit munia, nunc sese vix omnino in lecto commovere audet, quod si, nisi admodum caute, sategerit, ex templo paroxysmum (secus non nisi post plures horas invasurum) eumque multo severiorem, certo accersit. Parum hac nocte, præ dolorum molestia dormit, qui caput nunc atrocius infestant: Horum cruciatus mane in turbulentam somnolentiam transit, cujus etiam causa toto die Dominico à lecto abstinere nequit; nempe matutinis horis dormitat quidem, sed inquiete, atque aliquoties è somno expurgiscens potum exposcit, quo sumpto se iterum somno tradit. Hora circiter duodecima, si non sponte evigilet, astantium interpellatione excitatur, cibosque monita sumit, rerum omnium circa se transactarum adhuc probe conscia: dein statim in somnum relabitur (nisi verius animi torporem dixeris, quippe nec excitari amplius potest, nec cujusvis rei nunc actæ memoriam retinet) cum frequenti corporis in lecto jactatione; quo ad sextam præterpropter horam vespertinam detinetur. Hac hora ingruunt convulsiones, sed interpolatæ, ad horas quinque eam exercentes; quæ primo mitiores, tandem circa horam undecimam maxime

ime violentæ evadunt; per quarum intervalla oblatam Allam (tenuiorem enim potum ipsa, dum mente constat, vetat sibi in paroxysmo porrigi, noxam inde ventriculo imprimi experta) avidè haurit. Elapsa hac hora redit, qua per tot horas caruit, mentis usura, omniumque deinceps agendorum notitia, verum reliqua noctis parte se irrequieta in cubili jactat, prorsus insomnis. Die Lunæ, circa horam nonam matutinam, lecti tædium non amplius tolerare valens, ex eo surgit, sed toto die universo corpore dolet, & quamvis hoc die sat libere domum suam obambulet, jurisque nigri pocula hospitibus propriis manibus ministret, artus tamen rigidos quasi, adque motum parum aptos queritur, qui tandem somni placidissimi, sequenti nocte obrepentis, mulcedine torporem deponunt (nulla tamen accedente, sive per sudorem, sive urinam, sive alio quocunque modo, saltem sensibili, critica evacuatione; ut primum mihi sit conjectare, materiam, ex cerebro detrusam, à sanguine resorberi, in fermentum pro novo paroxysmo excitando denuo maturandum) duorumque hinc vel trium dierum induciæ conceduntur, donec novo aggesto fomite eadem denuo adornatur symptomatum scena. Nulla à multis retro annis admittere voluit remedia, utpote eorum infructuosa administratione tamdiu, ante hac lassata. Unum præterea satis rarum occurrit, quodque forte mente eam minus constare suspicionem daret, nisi ubique notum esset, nervoso genere affecto, notabiles inde impressiones in animum fieri: Nempe à longo tempore persuasam habuit se, si extra fores se proriperet, paroxysmo confestim tentandam iri, proinde se intra proprios parietes continenter per aliquot annos clausit; cum vero ante viginti annos præ importuna sollicitatione vicini cujusdam ædes coenatum adiret, statim atque in illas se receperat in eum, prout mens ominata fuerat, extra usitatam periodum incidit, ut necesse habuerit domum reportari, ubi solito graviorem perpeffa est. Exinde

de nunquam extra limen suum excessit, nisi cum ædes ante octodecim annos (in cathedra deportata) novis mutaret, quo momento, licet haud statò recursus die, invasere paroxysmi, perque decem dies continuos, bis in singulis invadentes, persistebant, donec tandem ad solitum redierint tenorem; Veruntamen pedem unum extra limen imò totum corpus, modo pollicis pedis summum apicem intra limen detinuerit, exerere & audet & solet; integro autem corpore vel latum unguem inde excedere nec audet, nec ullo pretio obtinueris, non si talentum obtuleris. Cum olim famosus ille Chiriater *Greataraksius Vigornie* ageret, ad hanc adductus est, ut quid in tam raro affectu valeret ipsius manus experiretur: illa autem, audito hunc eo consilio appulisse, nondum tamen viso, in gravissimum paroxysmum incidit, qui non ante septimum ab insultu diem eam deseruit. Interea toto hoc tot annorum curriculo nullam extra paroxysmos vel intellectus, vel functionum cæterarum animalium, notabilem læsionem passa est, quin (cum bono, adque pinguedinem vergenti, corporis habitu, vultuque florido) non minus expeditè, pro ratione ætatis, negotia domestica, adque eam quam exercet vocationem spectantia, exequi videtur, quam si nullo omnino, præcipue capitis morbo laboraverit.

*An Abstract of a Letter of Mr. Leeuwenhoeck
Fellow of the R. Society, dated March 30th. 1685.
to the R. S. Concerning Generation by an In-
sect.*

ABout the latter end of the Summer of the year 1683. I took the *Semen Masculum* of a Dog, which was of about a year and half old. This I put into a Glaspip, and wrapt it up in soft leather, because the nights were something cold. This *Semen* I observed 4 days successively, and in the first, I found that severall of its Animals were dead. In the 2d and 3d day, there were yet more of them dead, but on the 4th, there were very few left alive; and so far I proceeded at that time. But in the beginning of *October* in the year 1684. I observed again the *Semen Masculum* of the same Dog, who was then very strong and Vigorous, and I found that after 7 days and nights, there were some few Animals yet left alive; a very few whereof swam as briskly as if they had just come from the Dog.

From hence I inferr, that these Animals, would have lived a much longer time, if they had been in the *Uterus*: also that Conception in *Females* is not always made *immediate post congressum*, but sometimes 9, or 10, or more days after it, if one of the Animals can then find the *Punctum* or proper place for its Nourishment: and lastly that the *Uterus* may not be fit for the Reception of Animals at one time, tho' before 2 or 3 days are past, it may become perfectly capable.

I know my Opinion about *Generation* has been rejected by several persons, some whereof being skilled in Anatomy have affirmed to me, that the *Semen Masculum* never comes into the *Uterus*; that its never to be seen in that place; and that its nothing but a *Vapour* which causes fruitfulness. But I am not of these mens minds, for it seems plain to me, that the parts are proportioned
by

by Nature for the carrying the *Semen* into the *Uterus*. And therefore *Wolves*, *Foxes* and *Dogs* are fastned, and tho' the *Dog* at first sheds a little thin clear moisture, yet that is not a true *Semen*, for I could not find any Animals in it. But as he is fastned, there drops very leasurely a little *Semen* which is *white*, by reason of the great number of Animals contained in it: and this would not reach the *Uterus*, (because of its coming so slowly, and of the swelling of the *Penis*,) unless the *Dog* were fastned.

I remember that Dr. *Grew* formerly Secretary of the *Society*, in a letter to me, used some words to this purpose. Your *Harvey* in his Book *de Generatione Animalium* denies that he ever found in the *Uterus* Anatomised immediately after conception, the *Semen Masculum*. And our Dr. *de Graaf* in his Book *de Partibus Muliebribus Generationi inservientibus*, constantly asserts, that the *Semen Masculum*, is nothing but a Vehicle of a certain Volatile Salt, or such like spirit, conveying to the Egg of the Female a *Contactum Vitalem*.

But tho' a late Writer has reckoned up the Authorities of 70 Persons, who have asserted the same Opinion, and that of the *Ovarium*, yet I think they have been all mistaken. As will appear by the following Tryals.

I bespoke a *Bitch* of an ordinary size, to be delivered to me after she had been once lined, which hapned to be the 30th of *December* last, upon the next day at 8 of the Clock in the morning, the *Bitch* was lined again, in my presence, and again at 2 a Clock in the afternoon, whereupon I caused her to be killed by running an Awl into the *Medulla Spinalis* near the head. As soon as she was dead, I bound her legs to a Table, and opened the *Vagina* where I found a white substance, which I took out & viewed with my Microscope, discovering it to be nothing but Scales (of that sort which cover the inside of the *vagina*) lying in a clear thin liquor.

Afterwards I opened the middle of the *Cornu* on the

left side, which was about 3 inches $\frac{2}{3}$ long, and as thick as a good quill, as at *K*. If I had only looked with my naked Ey, I should have said there had been no *Semen* (of a *Dog*) in it, but when I made use of a very good Microscope, I saw to my great satisfaction, a very great number of the living Animals of that *Semen*.

I then opened the *Cornu* towards the end as at *L*, and saw there likewise a good quantity of the *Semen*, which was very lively.

I opened the *Cornu* on the right side, and found a like number of the living Animals.

Then I opened that part of the *Uterus* which is between the *Vagina* and the *Cornu* as at *H*. which part was 1 and $\frac{2}{3}$ of an inch long: and here I found in the stuff lying on the inside of the *Uterus* a greater number of the living Animals then before, and I cannot think they were less then a hundred Millions.

After 3 and $\frac{1}{2}$ hours time, I went to communicate this my Discovery to an Eminent Physician, and Anatomist who could not be of Dr. *De Graafs* opinion about the descent of the Eggs out of the *Ovarium*, tho' he had been present at his Dissections. In his presence I opened the *Uterus* in another place, and shewed him the substance contained therein, having in it a great number of the living Animals of the *Semen Masculum*, tho' the weather was very cold and freezing, I likewise shewed him one of the *Plexus* commonly call'd the *Ovarium*, wherein were severall bloody spots caused by the breaking of some of the Water bladders or glandulous particles whereof they consist: which broken water bladders were still included in a very strong Membrane; the said Physician remaining convinced that Generation was more clearly explained after my way, then by Eggs suck'd out of the *Ovarium*.

I opened the *Vagina Uteri*, and caused it to be so drawn together with the *Uterus*, and *Ovarium*, or *Testicles*;

cles; the *Vagina* and *Uterus* have not the full length given them, because they should not take up too much place upon the Paper, but their breadth is true. The *Ovarium* with the glandulous particles, and water bladders, are of the same bigness as they appeared.

I suppose this figure may be spoke against by Anatomists, because it is not layd out according to Art, but I don't pretend to Anatomy, for I never saw a *Uterus* taken out except by my self, or by a Butcher.

Fig. 1. *ABCD.* is the *Pudendum* of a *Bitch* opened.

DEFG. is the *Vagina Uteri* open'd which was 5 Inches long. This I first examined in the middle about *F.* to see whether there were any of the *Semen Masculum* in that place, but I found none at all, but instead thereof a great deal of Scales, which in all likelihood belonged to the inward Skin of the *Vagina*, and were worn off; also severall Globules of that sort which makes the blood red, and a great many globules of a lesser sort.

I then examined it about *E*, but I found no other substance, but what I have now described.

Lastly I examined it about *G*, close by the *Uterus*, and I found very few Animals, but the Scales were there very plentiful, being at least 25 Scales to one Animal.

These last Animals I suppose were only such as were scatter'd in the way, when the *Penis* of the *Dog* was drawn out.

From these observations may be concluded, that not the *Vagina* but the *Uterus* it self is made for the reception and inclosing of the *Semen Masculum*; least the Animals should swim back, and come into the sheath, which would be unprofitable ground; for the Animals were swam forward in the *Uterus* 5 inches and $\frac{1}{2}$ which is the distance from *GHIK.* to *L.* and this way (by a rough calculation which I have made of their swimming) I suppose they might get over in about 40 minutes.

I opened likewise the whole length of the *Uterus*, as *PQ* seeking for the bodies, which they say are suckt from

the *Ovarium* in Generation, but as I expected I found none. For if it be layd down, that the greatest Eggs are the ripest, (as it is in all Animals that are Oviparous) I should not have had much trouble to discover them, if they had continued so great round bodys as those in the *Ovarium LMNO*, or such bodys as are represented in the *Ovarium QRS* which is but half its bigness.

The *Uterus* of a *Bitch* is from *IK* to *L* almost of an equall thickness, but at *L* it becomes immediately very small (contrary to the *Uterus* of a *Sheep*) and how is it to be comprehended, that so great round bodys as the Eggs, can pass thro' so narrow and wrinkled a Passage, and not only one of them, but severall together; as in a *Bitch*, which being but once lined, brings severall Puppy's. That I might satisfy my self herein, I separated the thinnest part of the *Tuba* from the *Testicle* (for otherwise the length and end of it is not to be seen) and bound a thread about the *Tuba* where it grows thick; partly that in the mouth that sucks down the supposed Eggs, (where I have put a great Pin to shew the Cavity) I might pour Quick-silver for the discovering how much the thin stiff *Tuba* would stretch it self; and partly that I might know whether the round Membrane which contains it, and reaches from *L*, to *O*, as *ON* had a hollowness.

Fig. 2. VWX. is the thin end of the *Tuba*.

T. is the thread bound about the thick part of the *Uterus*.

X, is the opening where the Quick-silver is put in.

The *Tuba* did not stretch it self any wider then is here represented, nor did it loose that krinkled form which it had while it was in the *Ovarium* as is represented at *W*.

The *Uterus* at *TV* stretcht it self very much by reason of the Quick-silver, and from thence I am ascertained that it hath no other Passage then at *X*. for if it had, the Quick-silver would have run out of it.

Here hence will appear the impossibility that the great
Glandulous

Glandulous bodys in *LMNO*, and *QRS*, should go thro' the small Passage *XWV* in *Fig. 2d.* till they come to the widening of the *Uterus*; and I must confess (tho' this *Bitch* was as likely as any could be wisht) I could not find any round particle in it, that was bigger then a Globule of the blood, which makes it red.

About the middle of *January*, I procured another *Bitch* which had been Proud 3 days, in which time (they said) she had been lined thrice, and when she had been lined a fourth time in my presence, I opened the *Uterus* in the same manner as I had done the other. But tho' I found a great quantity of the *Semen Masculum*, I could not find any body bigger then a Globule that makes the blood red; and if there had been any thing so big as the $\frac{1}{100}$ part of a Sand, I doubt not but I should have discovered it.

Likewise in the *Vagina Uteri*, there was nothing but what I have formerly mentioned.

I understand that Dr. *De Graaf*, when he Anatomised female Rabbits, used to judge how many young would next have been brought forth, by the number of red specks in the *Ovarium*, tho' none of the Eggs were to be found in the *Uterus*. He was also of the Opinion, that the Eggs first came down in the *Uterus*, 4 days after the female had taken the Buck. But its strange that Rabbits should be compleatly made in 30 days, and yet the Eggs first be seen in $7\frac{1}{2}$ parts of the time.

In the year 1678. I sent your Honours, the draught of one of those numerous Animals, which are in the *Semen* of a *Dog*, noting that they are so small that 1000000 are not equall to a course Sand, I shall here again insert the same figure, that you may see how I imagine these Animals came to be round in the *Uterus*.

I need not mention how severall Insects cast their skin, and how Tadpoles as they grow in bigness, loose their Tails, and appear to be Frogs.

Fig. 3. EFGH. is one of the Animals of the *Semen* of a *Dog*, as I saw it swimming.

Fig. 4. IKLM is one of the Animals when its dead. I have often observed these last Animals to change their figure, chiefly when the moisture wherein they live, and swim, is exhaled.

When one of these Animals has got so far in the Womb, that it finds a place fit to nourish it, then may it suddenly cast off its Tail, or its whole outward covering, and remain of an Ovall form, as *Fig. 3. FGH.* or *Fig. 4. IKL.*

Again we find that the Bodys of Animals, while they are in the Womb, are so bound together, that they appear round. This is daily seen in larger Animals, and is undoubtedly the same in Insects.

I likewise am perswaded, that no Animal is changed or casts his Skin, without there be another Skin left to cover his body. This we find in Cater-Pillars, which as soon as they are come to their growth, and have spun their Case, they change not only their first Skin, and become a *Chrysalis*, but are yet encompassed with another Skin; and thus I believe it is with the *Animalia Seminis Masculi*, for they no sooner loose one of their *Membranæ* or Coats, but there remains another, which continually encompasses the *Fetus*, and grows together with it, till it comes to a Birth.

Its supposed that Animals while they grow in the Womb, have a living Soul; now if this be so, its a thousand times more likely, that the Soul which is in the *Animalia Seminis Masculi* should still remain there, changing only their outward shape, then that they should pass into another body.

I am also perswaded, that the living Soul which is in an Animal of the *Semen* of a *Cock*, does not loose it self in the parts of the Egg; but the parts of the Egg pass into the living Animal; so that the Egg of the Hen serves only to nourish and feed the living Animal. like-

Likewise I believe, that what is called frigidity in some men, is either a want (in them) of the *Animalia Seminis*, or a weakness in the Animals which renders them unable to live long in the Womb. And to this purpose I was lately informed of a Person, who tho' he had formerly had Children, wanted now the *Animalia Seminis*, which might be the reason of the present defect.

If this be true then, that a *Fetus* is an *Animal Seminis Masculi*, we may reject the Vulgar Opinion, that a Conception comes to be Male or Female according to the prevalency of one Seed above the other, since the *Animalia Seminis* are themselves of both Sexes.

In the beginning of Frebruary I received from a Butcher, the *Uterus* of a Sheep, which had taken the Ram 17 days before (as they said) I found in one of the *Cornua* thereof, a small body wrapt up in Membranes of a red fleshy colour. But being not able to distinguish its figure, tho' I put it in a Glas Tube about the thickness of a goos quill, together with Oyl of Turpentine; I took it out of the Glas again, and as it lay round, I gently stretcht it out in length, at which time I plainly saw the back bone, likewise blood Vessels lying thereby, and sending forth several branches, also in 2 distinct places the *Medulla Spinalis* lying in the Back bone. And in the head, I saw not only the *Maxillæ* but the Muscles that covered them, and the Vessels lying in them, tho' they were not yet red and lookt like sinews. Likewise the Brain, and the small blood Vessels therein, the Eys that were about the bigness of a course Sand, but as clear as Chrystall; I opened the Belly and took out severall pieces of the Bowels, which were transparent, and about the size of a small hair. I saw severall strings of flesh, which I took to be the Muscles: when I cast my Ey on the Breast to see the Ribbs, I found the place so full of blood vessels, that there was nothing else to be taken notice of.

This whole Animal I judged to be no bigger then $\frac{1}{4}$ th
Y y part

part of a Pea. And if so small a creature be furnisht with all its parts, there can be no reason to doubt, that the same creature has them, tho' he be a thousand times less, and the parts are not distinguishable by the sight. And if an Insect has limbs and Bowels, tho' it is not a thousand Millionth part so big as a sand, then may the *Animalia Seminis*, have likewise the same Limbs and bowells, which the *Fetus* has when it is brought forth.

Furthermore I took out of the Ovarium which was on the same side where the *Fetus* lay, 2 round red globulous bodies, commonly called Eggs, each whereof was about the bigness of a Pea, and consequently each Egg was about 8 times as big as the foresaid whole Animal.

These supposed Eggs, tho' I took them from between Membranes, were each wrapt in a Skin, or Membrane, that had blood Vessels running upon it; and when I opened the Eggs, I found they consisted chiefly of a Glandulous substance, and every glandule likewise consisted of other lesser glandules.

I bought a female Rabbet and let it take Buck 3 times in my presence, (which was quickly done) and then killed it, but did not open the womb, till a quarter of an hour after; about an Inch from the beginning of one of the Horns, I found a little fluid matter containing some few living Animals of the Male seed, but in the parts where the *Cornu* joyns to the *Vagina*, the living Animals were very numerous; in the middle of the *Cornu* and toward the further end, there were no Animals at all, nor any thing to be seen but a few blood globules swimming in a little fluid matter. The reason why the *Animalia Seminis* were not throughout the *Cornu*, I believe may be, that the Seed had not been long enough in the Womb, and therefore the Animals had not time to disperse themselves all over it.

The other Horn, being yet untoucht, I wrapt it up in a piece of Paper, and put it in a small Box which I carried in

in my Pocket (because it was cold weather) from 9 a Clock in the morning (that I made my first Observations) till 3 afternoon, at which time I opened it, but found it little differing from the other horn, either in the Number of the Animals, or in their progress therein.

I opened the Womb a little below the Horns, and found a greater number of the *Animalia Seminis* than I had yet seen; but in the outermost part of the *Vagina* there were no Animals at all.

In both the horns layd open, I could find no round body bigger than a blood globule.

I then endeavoured to discover the make of the Animals, but it proved a work of great difficulty, yet I saw (after many observations) that their bodys are not Ovall, but flattish, *Fig. 5.* *ABC.* is the body of a dead Animal of the Male Seed of a Rabbet, which I had taken out of the Womb of the Female. In the foresaid bodys there oftentimes appeared 6 bright risings of a Globular form, placed after the manner they are here drawn, but the bright rising or Globule nearest the Tail was generally bigger than the rest, as it is represented at *C.* Tho' some of the bodys were without these Globules, yet I could sometimes perceive that at the Tail.

CD. Is the Tail lying in Bends, as it usually is when the Animal swims.

In any of the severall Seeds which I have observed I cannot say that the Animals are ever at rest, as long as there is any fluid matter left to move in, but their motion is continuall, till it decreases gradually as they come to dy.

There are some Animals which have also a small globular substance in the Tail, but it is not to be discovered without great attention.

Fig. 6. *EF G.* is the body of an Animal, having
Y y 2
only

only one Globule at the Tail, and another in the Tail.
G H. is the Tail of the Animal.

I have said That the Male Seed of the Rabbet was in the beginning of the Horns, but not throughout, as in Bitches; that I might be sure of this Observation, I let a Female Rabbet take Buck twice in half an hour time, and then let her live 6 hours after, at which time I kill'd her, in the presence of a Physician, who had been a Companion of Dr. *De Graaf* in his Anatomising of Rabbits. When I had taken out the Womb, with the Appurtenances, I opened one of the Horns in 3 several places, at the beginning, in the middle, and at the farther end; and took out of each place some of the stuff, which I shewed him in a Microscope, satisfying him, that the living Animals of Seed were throughout the Horns, and did not only move, but discover the distinct motion of their Tail.

I shewed him likewise the supposed *Ovarium*, in which were no red spots, but a great many water bladders as big as a pins head: for which he was very thankfull, desiring only to be convinced, that the Animals he had seen, are the same which come from the Seed of a Buck Rabbet, which I have promised to do, both from the *Vasa deferentia*, and the Testicles.

I likewise upon his desire, shewed him the stuff contained in the water bladders, which was nothing but a transparent moisture mixt with some blood globules.

The other Horn of the Womb being not then opened, I layd it in a Box on a moist paper for 16 hours, and then I found in it a great many living Animals. But in one place there were 25 dead for one alive, and in another place 100 dead for one alive. After 5 hours more, I lookt again, but then the Animals were all dead.

My intention had been formerly to prosecute in *Bitches* my inquiries about Generation, But I found them not so convenient as Rabbits. First, because *Bitches* are harder to come by at all times, and again because they are proud

8 or 10 days together, which makes it difficult to know how many days they have been with whelp; whereas Rabbits after they have been Buckt, are quiet in a few hours.

I therefore again put a Rabbet to Buck, and after 2 full days kill'd her, searching all the Horns of the Womb, and finding only a few Animals, but nothing else remarkable, saving that there were no Eggs; some round particles lay here and there, but they were 1000 times less then a Sand. I saw likewise some blood Vessels in the *Cornua* which were so small, that a blood Globule could not pass thro' them, without being broke into 64 parts. When I lookt on the *Ovarium* with my naked Ey, I thought I saw 8 or 9 red spots in it, but when I lookt with a common Microscope, I saw they were water bladders one redder then another, and containing some bloody matter, which consisted of small Glandulous parts, joyned together with Membranes, having many Globules of blood spread among them, whereby one of them was become blood red.

Afterwards I killed a Rabbet which had been Buckt 6 days before, and when I opened one of the *Cornua Uteri*, I saw therein a round water bladder about the bigness of a Barly corn, having a tender Membrane, seeming to be made of Globular parts, and shewing thro' a common Microscope like the grain of Shagrin; this I imagined to have come from an Animal of the Male Seed, but when I opened it, and searcht thro' all the watery stuff that it contained, I could make nothing of it, but that I thought I saw something having the form of a Rabbet, but a 1000 times less then a Sand. Yet I cannot be positive, since in the other Horn of the Womb, I found 2 such round bladders which had not the same appearances: tho' its probable an Animal might have harboured therein.

When the watery stuff began to evaporate, I saw a great number of six sided figures, whose sides rose up Pyramidally

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(like those described in my last letter Numb. 3. *Fig. 4.* where I spoke of Allum) being clear as a polished Diamond: about them lay brown Globules, pretty to look on, especially in the Evening, when the light of a Candle passing thro' them, makes a glistering. The greatest of these Salts would cover a hair of ones head; but the least could not be distinguished by a Microscope that magnifies a hair to the thickness of ones finger, and from hence may be judged the smallness of some Salts produced in this moisture. There were likewise some Salts having a square Basis, and others an Oblong, but their number was few and scarce worth taking notice of.

The preceding Observations were made in a moderately dry season, but 2 days after when it was rainy weather, I lookt for the same Salts, but they were melted, and run among the brown Globules.

I examined the *Ovarium*, and found in it 2 or 3 water bladders which lay deep and were half hid, and one that was reddish, the rest that stuck out more, being the greater number, were of an ash-colour and consisted of Glandulous parts. I lookt also how the Eggs might have a Passage to come down, but could find none.

I received from a Butcher, the *Uterus* of a Sheep which was said to have taken the Ram 3 days before, as I opened each of the *Cornua*, the moisture run plentifully out, which I put separately in 2 Dishes, searching with my common Microscope till I found a small body of about the bigness of a coarse Sand. At first I could perceive no figure it had, but when I applyed it to a good Microscope, it proved to be a young Lamb, with the head and back bent forward, but in very good Order: the jaw bone and Eys, were very distinct, but the back bone much less. I intended to have shewen the Animal to some Learned Men, but in handling it, I had the misfortune to bruise its head, which made the parts thereof indistinct, and when I separated the body, the Bowells dried

dryed so fast, that I could see only a piece of them. The little Creature had no blood particles about it.

From all the preceding Observations, I am more and more confirmed, that the supposed *Ovariums* are only Instruments for the disburthening the parts thereabout; for if they were true *Ovariums*, the Eggs would first be little when the Animals are young, and grow bigger & bigger against the time that the Animals come to procreate. As it is in Birds that lay Eggs. That I might satisfy my self and others herein, I examined Calves of 3, 4, 5, and 6, weeks old, and shewed (in the presence of 4 Physicians) the Eggs as big as if they had been of a full grown Cow, for they were like peas.

Again I made appear, that the Eggs in a sucking Lamb, were as big and bigger than in a full grown Sheep; and the Glandulous parts and water bladders as many.

I have been often considering, whether the opening of the *Tuba* might not be to give way for the evacuating some moisture at the time the *Uterus* is closed, and which cannot get thro' the *Vagina*, for I have sometimes found in the thin part of the *Tuba* near the Opening, a white stuff consisting of transparent Globules a little bigger than a blood globule.

There lately came to my hand a Book called *Collectanea Medico Physica*, in which Cent. 5. pag. 8. are some words to this purpose. *But its most surprising what the learned Boutekoe relates from the Curious Leeuwenhoeck, that the Sperm of Men is full of small Children, and so the Sperm of other Animals according to their kind.*

But this is a mistake, for I have only said its full of Animals, or Worms, with long Tails, whose figure I have often shewn. For as it is not proper to say, that Worms swimming in the water are flying Insects, tho' they come from them; or to say that the Kernel of an Apple is a tree, tho' a tree comes from it; so its no less improper to say, that the Worms in Mens Seed are Children, tho' Children come from them. Its

Its often said that a Tree may be seen in the Kernel of an Apple; but I must profess, that a Seed (laying aside the Radicle whence the Root springs) consists of roundish transparent Globules, which when it grows, turn into Cylindrical bodys, being Vessels to carry the nourishment to the Radicle, but when that is sufficient to draw its nourishment from the Earth, the remaining part of the Seed does no more service to the Plant, but dryes away. 'Tis true, when we examine severall Seeds, we find in them 2 or more beginnings of leaves, as small as a small Sand, these ly folded up, and shew in a Microscope like the Beak of a Sparrow, but when they are unfolded, we then see the beginnings of other leaves, which grow not till the root is bigger. These last Observations have been made on Seeds, just taken out of an Apple, or a little dried. But if you cut up a Turkey-bean, tho never so dry, the 2 leaves are visible to the naked Ey, but if you use a Microscope, you see the Ribs or Vessels of the leaves, for they are partly made to stiffen it, and partly to carry nourishment for its growth, &c.

A Discourse on the Dissection of a Monstrous Double Catt; read before the Dublin Society by Dr. Mullen.

GENTLEMEN,

I Had given you an account before this time of a *Monstrous Catling* that I lately Dissected, but that my busyness would not give me leave to put it in writing till now.

When I met with it, 'twas dead, and I am perswaded that it was so brought forth, the Lungs being compact and free from *Air*; which they could not be, if it had ever inspir'd.

It was double from the Navell downwards, having 4 hind feet, two tails, two *Anus's* and two *Pudenda*, for they were Females. They were joyn'd in one Trunc at the Navel and were continu'd so upwards; but yet this Monster had two pair of fore feet, one of them on the back and the other on the breast. The head though single had two pair of ears, one Naturally Sited, and another at the hinder part of the head, between the *processus mammillares* to which the *Vertebrae* of both the Necks were joyn'd, for there were two back bones continu'd all the way to the head. Though the two bodys seem'd to be but one intire one above the Navell.

The 6th *Figure* expresses to the life its outward shape when placed on its back, for the Tails, Feet, Navell, Mouth, Nostrills and Ears, Naturally situated are represented in their full proportions.

There was only one Stomack under the Liver in the right side, reaching under another Liver in the left. The Guts were single till within 6 or 7 inches of the *Anus*, and there was a division into two branches, one

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going to each fundament, below the division there were plainly to be seen two *Cæcums*, with in about 3 inches of the *Anus* each. There were two Livers one much smaller then the other; that which was in the right side was the least, the other lay lower down in the left side. They were both intire without any division or lobes. There was a *Vena Umbilicalis* inserted into each of them. There were two artery's inserted into the Liver in the left side, both coming from the *Aorta*, and these I shall call the *Celiacæ*. There was only one inserted into the Liver placed in the right side. There was no *Vena cava* below the Livers, for all the Veins coming from the lower parts entred the Livers as the *Vena Porta* does naturally. There was a branch of a Vein on each side proceeding from the Loins inserted into the back-parts of the Liver, and besides these there was not a branch to be seen but what was inserted into the middle of the Livers.

There were no *Vesiculæ felleæ* that I could find, and perhaps the reason I could not discover any, was, because of the tenderness of the Livers; for they were putrid before I got the *Catling*. There were two Kidneys on each side furnish'd with ureters. There was neither spleen nor *pancreas* in either side.

There was a double Diaphragm meeting in the middle between the two back-bones, and making a membrane, which to me seem'd to be a *Mediaſtinum*; for it reached up to the *Thymus*.

There were two hearts in it, one placed above the other, and a little to the right side, it was much higher then ordinary, and it had a Vein comeing to it from the little Liver in the right side, which (together with 3 other small Veins, one from each of the fore-feet and one from the head) furnish'd this heart with what blood was to be circulated by it. It had onely one auricle, and one Ventricle, so that it seem'd to be but half a heart.

There

There was a pretty large passage into the *Arteria Aorta*, the contrivance of which was very singular. For above this heart it was made like an Arch of a Circle, into which there was a direct passage from the heart for the blood. When I further examin'd this Artery I found that it went down on each side on the *Vertebrae* of the backs between the Kidneys and divided it self on each side after the usuall manner after it had lent each Kidney a branch, the Liver in the right side one, and the Liver in the left side two.

The 7th *Figure* expresses this, as by the explication of it shall appear.

Below the former a little towards the left side of it there was another half heart, having only one *Auricle* and one *Ventricle* like the former. This received little blood but what was transmitted from the large Liver in the left side by that that is called the *Truncus Ascendens* of the *Vena cava*.

The Artery carrying the blood from this heart was inserted into the Artery lately describ'd as well as that of the other heart.

So that if the blood circulated through either of them the whole Animal must necessarily be supplied with blood; a contrivance not unlike that of the Arterys under the brain, where the *Arteriae carotides* and *Vertebrales* doe empty themselves into one common channell from which all parts of the brain may easily be supplyd with blood. This is partly expressed by *Fig. 8th* but not so clearly as I could wish.

How far it is represented we shall see when we come to the explications of the *Figures*.

The head was join'd to two necks about the *processus Mamillares*. *Fig. 9th* represents the holes through which the *Medulla Oblongata* was continu'd into the *Spinalis*.

There were four orders of ribs, though the body was

but one above the Navell. That which outwardly seem'd to be a back was really the place where the ribs met, and which might be rather call'd the breast, though it wanted a *Sternum*.

The 10th *Figure* represents this;

Fig. 7th represents the Cat open'd so as that most parts are to be seen, where 1. represents the Stomack pull'd from behind both the Livers so as to be plainly seen. 2. The beginning of the guts below the pilorus. 3. The Division of the gut into two branches whereof one went to each *Anus*. 4. 4. The two *Cecums*. 5. 5. 5. 5. The two pair of Kidneys furnish'd with emulgent Artery's and Veins. 6. A large Liver in the left side much lower situated then the Liver in the right side. 7. The Liver in the right side with a Vein. 8. Coming from the Kidneys of the same side after it had united above the emulgents. This supplies the office of the *Vena cava* and *Vena-porta*. 9. 9. Two large branches of the big Artery going into the body of the big Liver. 10. 10. 10. 10. The great Artery supplying both sides with blood and receiving of it from the two hearts. 11. The Vein bringing the blood from the lower parts of the left side into the Liver 6. of the same sides. 12. 12. The big Artery sending branches to each of the Kidneys. 13. The upper heart. 14. The Artery that supplied the head with blood. 15. 15. The axillary artery's. 16. The *Vena Cava* coming from the Liver in the right side to the heart 13. 17. The passage from the said heart to the Aorta.

Fig. 8th. 1. The Liver in the left side freed from all things that kept it any way out of sight. 3. The *Vena Cava* passing from it to the lower heart 6. 2. A Skirt of the Diaphragm turn'd to the left side that the former Vein should better appear.

4. The

4. The Stomack displaced for the former reason.
5. 5. 5. 5. The Kidneys as formerly.
6. The other heart placed lower then the former and in its due situation
7. The upper heart drawn out of its place upwards that the other 6. with the passage 11. from it to the *Aorta* 9. 9. might be well represented.
8. The Liver in the right side doubl'd and turn'd over the heart 6. that it might be the better set forth.
9. 9. 9. The *Aorta* where it is not hid by the parts displaid for the former reason.
10. The Lungs not well represented.
11. The passage from the lower heart into the *Aorta*.

Fig. 9th This represents the Skull open'd and freed from the brain, that so the passage into the 2 back bones may be seen.

1. 1. The hollows through which the *Medulla Oblongata* was continu'd to the *Medulla Spinalis*.
2. 2. The two Necks.

Fig. 10th. 1. 1. The 2 diaphragms separated from the Cartilages of the Ribs, that their junctures may be seen.

2. 2. 2. 2. The *Vertebræ* of both the backs.
3. 3. 3. 3. 3. 3. The juncture of the 2 Setts of Ribs that were at the back.
4. 4. 4. 4. The two Setts of Ribs that were joyn'd to the breast.
5. The tips of the Diaphragms pull'd downwards to shew the Ribs plainly.
6. 6. The *Vertebræ* of the 2 Necks.

MICHAELIS ETTMULLERI *opera omnia Theoretica & practica, &c. Quarto Londini 1683.*

THIS Author (for whom his former *Treatises* had prepared a welcom in the world) divides the Practice of *Physick* into ordinary and extraordinary, the former he looks upon to be defective in these two things; first in sufficient *Experiments* on which to ground a *theorie*, and secondly, in generous *medicines* as well universal as specifick, which should have their effect without Nature's too hard labour, the former to be supplied by Anatomy, the latter by *Chymistry*. In curing any disease he observes these five heads, the history of the distemper; the part affected, the causes, prognosticks, and method of curing. He looks upon it to be of the greatest consequence to distinguish between the Animal faculty placed in the spirits and *Genus Nervosum*; and the vital, whose seat is in the blood, and *Viscera*. He allows in the blood two motions, the circulatory, and fermentative, to this he supposes the concurrence of an Acid and an Alkali, the foundation of which motion is that *Seminal crasis*, which is preserved by a due use of the *res non-naturales*, and restored by proper medicines.

In the *Animal* faculty he considers its nourishment, which is *Chyle*; and its structure, the delicate *Fibres* of which are the instruments of sense and motion, on both which Scores it is subject to convulsive motions, when irritated; or Paralytical impotence when obstructed. These foundations being laid, he recommends *Sylvius*, and *Willis* to the Reader, and gives the necessary cautions for their Reading, looks upon *Sennertus* to be sufficient among the Antients, as containing the sense of all
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of them, & looks upon *Helmont* to be very faithfull where intelligible, and to be imitated as far as possible, since he suggests the best method of curing *à priori*; upon this *Theorie* his whole work is founded, and consists of an universal praxis divided into three parts. The first treating of the loss of appetite, and its consequences and cure of them; the second of nutrition vitiated, &c. The third, of the diseases of Women, to which he adds his *Chirurgia medica, & Collegium Consultatorium*.

To all this is added an appendix consisting of several *Tracts*, the first is *Valetudinarium infantile* in which he gives an account of the nourishment of *Infants* with milk and pap, as also of the diseases incident to them while in this state, the general causes of which he reduces to these two heads, *viz.* the retention of the *Excernenda*, especially that *Meconium*, and insensible transpiration; and secondly the ill giving of bad nourishment, or *vicia lactis & errata pullis*. Hence springs that Acid juice, the different condition of which is the cause of that succession of distempers, infancy is afflicted with; to which he opposes those general remedies which shall destroy that Acid, incide, attenuate, and evacuate it, of which nature he gives particulars, in briefly handling each particular disease.

The next is his *Treatise de vi diaphoretica Opii*, which being already well known I shall give no farther account of, but pass on to the third which is *De Coralliorum Tinctura*, in which first he treats of the nature of coral, and after arguments on all sides concludes it to be a stony concretion in form of a Shrub, generated from a nitro-saline mineral juice impregnated with a sulphureous clammynefs elevated by the subterraneous heat, through the pores of the bottom of the *Sea* where by the cold and saltnefs of the *Sea-waters*, it is congealed. After this telling us that only is a true *Tincture* in which there is a portion of the proper substance of the body from
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which it is extracted, with a concentration of the colour and virtue of it extracted and exalted by a proper *Menstruum*; this he applies to the pretended *Tinctures* of *Coral*, the last of which he mentions is of a certain *Chymist* at *Paris*, who with the phlegm of the distilled water of the Air gathered at a certain time, can extract not only the *Sulphur* but the *Salts* of *Coral*, which appear in a *Cubick* form upon evaporation in the *Sun*, the rest of the *tincture* swimming over it like juice of *Berberry's*, the conclusion is of the use of it, which he allows to be great in strengthening the tone of the inward parts, quelling the effervescencies of the blood, &c. which effects are alterable by the *Menstruum* with which they are drawn.

The fourth tract is *De præscriptione Formularum in Genere*, in which he considers the matter which consists of the ingredients of all three Kingdoms; the form is nothing but the order, proportion, manner of prescribing, and the certain texture into which the matter does by mixture combine.

Concerning the ingredients, respect is to be had to their quantity according to its three dimensions, longitude in their number, latitude in their dose, profundity in the mass or consistence; their quality is that apparent similitude and contrariety both in respect to one another, as to the body of the patient, so that he requires as previous to the writing a receipt the exact knowledge of the *Materia Medica*, and an exact skill in their preparation; and having layd down necessary rules and cautions to be observed in prescribing, he gives examples under several classes of Powders; Pills, Mixtures, Infusions and decoctions, and ointments; as to these latter he gives these two cautions, 1. that they consist of a volatile matter, and easy to be dissolved. 2. that nothing be mixt which will not admit of a total and equal solution.

Next follows his tract which he calls *Parva Magnorum Morborum initia*, where having proved by induction of
several

several instances that Nature produces great effects from small and invisible causes, witness the *Animal Spirits*, the objections against whose existence he first removes, and then demonstrates, he discourses of the effects of imagination, of Poysons, of contagion, and other preternatural ferments as inconsiderable for their bulk, as monstrous in their effects, as also of the least prick of a Nerve, he concludes that as great diseases have those minute causes, so likewise their true *Remedies* are of small quantity, but of great efficacy.

His discourse *De usu & abusu præcipitantium* is divided into three Chapter's, the first is *Historical* of the *Turgescentia* and *Orgasmus* of the humours, to which are opposed *Remedies* that precipitate and consequently repress that exorbitancy, of these he gives the *History*, assigning to *Sennertus* the invention of the notion, and discoursing of the most considerable of them in each of the three *Kingdoms*. The second Chapter is *Theoretical* of the nature use & manner of working of them, & that founded upon the nature of precipitation in general, which he asserts to be found in the fluids of our body as well in a state of health as sickness. His third and last Chapter is practical wherein is discoursed at large how they ought to be given, and with what sort of *Medicines* most effectually mixed.

To this succeeds *De Morfu Viperæ*, where from the assertion of *Celsus* that the biting of any Animal is venomous, he easily proves that of the *Viper* to be so, and having considered and rejected the various opinions about the seat of Poyson in the *Viper*, and proved that it is by no means Poysonous when dead, but each part of it antidotal, he looks upon the anger of the beast, or the *Idea furoris Archæi* imprinted on its teeth and *saliva*, to be that alone which makes his biting mortal; to this he adds the *Diagnosticks Prognosticks* and *Method of Curing*.

The last tract is *Medicina Hippocratis Chymica* which has been printed before, & in short is a demonstration of Hip-

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crates's proceeding in his practice upon *Chymical* qualities, and not at all depending on the qualities of the elements, and at last concludes from specifical taſts that there are ſpecificall remedies not to be found out by the common taſts and which conſiſt in the *Craſis* of concretes to be found out and conſerved by art, and by means of the liquor *Alkabeſt* ſomuch commended by *Helmont*, and confirmed by *Starkey* upon his own experience.

RAYMUNDI VIEUSSENS D. M. Monſpelienſis *Neurographia Univerſalis. Fol. Lugduni*
1685.

THIS curious *Author* after a ſhort account of the generation of the different parts of the body, out of a ſeeming homogeneous matter, divides the *Brain*, taken in a large ſenſe for the whole *head*, into its outward and inward parts, theſe latter being the ſubject of his *firſt book*: in which he begins with the *Craſſa meninx*, which he makes to be double, the fibres of each membrane obliquely interſecting one another, deſcribes its cohæſions, ſinus's, Veſſels, and uſes both publique and private, and explains how it becomes ſo exquisitely ſenſible, and whence it has its motion in thoſe parts where it is movable. Hence he takes an occaſion for a very curious digreſſion about the motion of the *Heart*, and *Arteries*, theſe latter he aſſerts to be moved by the blood, and brings an experiment to prove it, and alſo makes uſe of it to confute the pulſifick faculty of *Galen*, and the Animal ſpirit of *Willis*, which by the annular fibres of their middle coat, is to dilate and contract them.

He denies the *Pia Meninx* to have any gland's, is very particular in the diſtribution of the *Veſſels* of it, and will not allow the *Rete Mirabile* (of which he has a diſtinct Chapter)

Chapter) to consist of any thing besides *arteries*. The brain is divided into the cinereous or glandulous part, and the medullary or fibrous, which from its figure and use he calls the oval centre of the brain, looks upon the *Corpus c. illosum* to be the true *Fornix*, and having given the description of all the internal parts of the brain, gives us likewise their use founded upon their structure, and so passes to the *cerebellum*, in which he describes both the *processus vermiciformes*, gives an account of the *Valvula major Cerebri*, &c.

After the *Anatomy* of the brain, he discourses of the office of the brain and its parts, of the necessity and nature of the *Animal Spirits*, and *Suctus nervus*, and in treating of the *Lymphaducts* of the brain, describes exactly the *Membrana pituitaria*, and twelve *Sinus's* in which the blood before it enters the brain cleanses it self from *Phlegm*, these he divides into four sorts according to their situation, *viz. in sinus Sphænoideos, ethmoidæos, frontales and maxillares*. having discoursed of the matter, place and manner of the production of the *Animal Spirit*, of its dispensation, and distinct ways by which it moves within the brain, &c. He treats briefly of the *Animal* faculty's, and concludes the first book with a short Chapter of judgment and Reason.

The *Second Book* is of the *Medulla Spinalis*, where he observes the method of his first book, and first describes the four membranes of it, with their office; then gives an account of its Vessels, and denies that the *Sinus venosi vertebrales* are joyned or accompanied by the *Sinus arteriosi* of *Willis*; looks upon the *Medulla* to be the brain prolonged, as the *Antients* likewise accounted it, both as to the generation, and distribution of the *Animal Spirits* through those thirty pair of *Nerves* which proceed from it, and upon this account is the fountain of sense, motion and nutrition to the parts below the head.

The *third Book* treats of the *Nerves*, where after the definition

finition, and division of them into soft and hard, great or small proportionably to the labour they are designed for, he will not allow any of them to be sensibly hollow, not so much as the *optick* or *olfactory Nerves*, and as *ascribing* all their variety to the disposition of their pores, explodes as fabulous, the *Valves* some have supposed in them. Discourfing of the use of the *Nerves* he looks upon the common question, *viz.* Whether the *Nerves* are different by which motion and sense is made, to belong rather to the *Animal Spirit*, then to the *Nerve*, which likewise being uniform, the diversity of *Animal* action, doth not argue a diversity in either *Nerves* or *Spirit*, and having given us the number of the *pairs* of *Nerves* in the body, proceeds to describe them singly as they ly in the body. In his *last Chapter* he gives an ingenious account of the manner of the motion of the *Muscles*, founded upon the consideration of the mechanism of them, and the *vis movens*, which he makes out to be the *Animal Spirit*, and the blood, the necessity of both he proves from a palsy certainly ensuing upon the defect of either. All this Doctrine is illustrated by large and fair *cuts* answering the natural magnitude of the parts described.

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Smith at the Prince's Arms in St. Paul's Church-
yard London; and Hen. Clements
Book-seller in Oxford.*

FINIS.

PHILOSOPHICAL

T R A N S A C T I O N S.

For the Months September, and October; 1685.

The C O N T E N T S.

1. *Extracts of two Letters, written by the reverend Dr. Garden of Aberdeen; one concerning the Causes of several Winds, &c. to Dr. Plot: the other concerning the Proboscis of Bees, &c. to Dr. Middleton.*
 2. *An Explication of the Figures of some Antiquities; communicated by a Member of the Royal Society,*
 3. *A Letter of Dr. Lister's to Mr. Ray, concerning some particulars that might be added to the Ornithology.*
 4. *An Abstract of a Letter from the Learned Dr. Cole of Worcester, Concerning Stones Voided per Penem.*
- Accounts of three Books.* 1. JOHANNIS HEVELII, *Consulis Dantiscani, Annus Climactericus. Gedan;* 1685. in Folio. 2. *A Course of Chymistry; by NICH: LEMERY, M. D. Translated from the Fifth Edition in French, by WALTER HARRIS, M. D. Fellow of the College of Physicians, London.* 1686. 3. *Collegii Experimentalis sive Curios, pars Secunda, per JO. CHRIST STURMIUM. Altorfi,* 4^o, 1685.

Extracts of two Letters, Written by Dr. Garden of Aberdeen; one concerning the Causes of several Winds, &c. to Dr. Plot: the other concerning the Probolcis of Bees; &c. to Dr. Middleton.

Extract of the first Letter.

TH O the Observations I have yet by me concerning *Weather* be both few and of no great moment, yet I cannot refuse to impart them to the *Philosophical Society*, being they are pleas'd to call for them. They are such as I doubt not they have heard of already, and I give my conjecture about them meerly to excite others to enquire more narrowly into the truth of the matters of fact, and from what causes they may proceed. They relate chiefly to the *Weather* between the *Tropicks*, and I presume to transmit them to you in this paper and shall range them under these heads. 1. Concerning the winds which under the Line blow continually from East to West. 2. Anent the Western winds which are still to be found for some degrees on this side the *Tropick*. 3. Concerning the stated changes of the Eastern winds, blowing the one half of the year from the North-East and the other half from the South-East. 4. Concerning the stated Winters and Summers which are to be found at one time in distant places of one and the same *Country*. 5. The singularity of *Peru* as to this beyond any other part of the Earth. 6. Concerning the strong and lasting winds which blow over almost all the known Earth about the *Æquinoxes*

As to the first, it is generally known that there are continual Eastern winds under the line which they call *Trises*, and therefore the accounts of *Spanish Voyages* bear, that in their going to the *West-Indies* they sail Southwards from *Spain* along the Coast of *Africk*, till they be beyond the *Tropick* of *Cancer* within 20 degrees of the line, where they presently find an Easterly wind,
and

and so they fail on Westwards with full winds, so as they have scarce any need to touch their sails in the whole Voyage: and this they give as the reason why the Voyage from *Spain* to the *West-Indies* is shorter, more easie and more assured than the return to *Spain*. In the *South Sea* also going from new *Spain* or *Peru* to the *Philippines* or *China*, their Voyage is easie sailing always from East to West neer the line, where the Easterly winds blow in their Poop. *Acosta* reports that in the year 1584 there went a Ship from *Calloa* in *Lima* to the *Philippines*, which sailed 2700 Leagues without sight of Land and this in two months, without want of wind or any torment, and their course was almost still under the Line. For from *Lima* which is 12 degrees to the South he came to *Manilla* which is as much to the North.

Now these continual Easterly winds between the *Tropicks* I suppose to proceed both from the motion of the Earth and the Vertical influences of the *Sun* after this manner. As you know the vast fluid and *Æther* in which the Earth floats in its annual motion, moves forward with the Earth in that motion, or rather carries the Globe of the Earth along with it; even so the *Atmosphere* and a large Vortex of *Æther* beyond the *Moon* goes round with the Earth in its diurnal motion, which tho' according as it is removed from the Earth it may be proportionably slower in its motion, yet that portion of the *Atmosphere* which is nearest the Earth and surrounds it, may be supposed to keep equall pace with the Earth in its motion, and if there were no changes in the *Atmosphere's Gravity*, I suppose it would always go along with the Globe of the Earth from West to East in an uniform motion, which would be wholly insensible to us. But that portion of the *Atmosphere* under the Line being extreemly rarified, its spring expanded, and so its gravity and pressure much less than the neighbouring parts of the *Atmosphere*, here, and consequently incapable of the uniform motion to the

East, it must needs be prest Westwards, and make that continual *Brise* from East to West between the *Tropicks*. As to the second, the same accounts bear, that on this side the *Tropick* about 28 or 30 degrees there are to be found constant Westerly winds, and therefore the *Spanish* fleets from the West *Indies* do not return the way they went, but those both from *Peru* and new *Spain* sail along the Coast Northward till they touch at *Havana* in *Cuba*, and being joyn'd together there, they seek their height without the *Tropicks*, where presently they find Westerly winds which serve them till they come in view of the *Azores*, and from thence to *Sevill*. In like manner in the South Sea those which return from the *Philippines* or *China* to *Mexico*, to the end they may recover the Western winds, mount a great height till they come right against the *Islands* of *Japan*, and discovering *Caliphornia*, they return by the Coast of new *Spain* to the port of *Acapulco*, from whence they parted. So that tho' they sail easily from East to West in both Seas within the *Tropicks*, for that the Eastern winds reign there; yet returning from West to East they must seek the Western winds without the *Tropicks* in the height of 27 degrees.

Now the reason of this seems to me clearly deducible from the former; for the pressure of the *Air* between the *Tropicks* being continually less than the neighbouring parts of the *Atmosphere*, and so consequently by them pressed Westward, way being thereby given to the neighbouring *Air* for some degrees without the *Tropicks*, its motion from West to East is proportionably encreast beyond that uniform motion it would have if the whole *Atmosphere* were of an equall pressure, and consequently there will blow a constant wind from West to East for some degrees beyond the *Tropicks*.

The third thing I have had occasion to observe is, that by what I can collect from the accounts of Eastern Voyages, those Easterly winds between the *Tropicks* do not
blow

blow constantly from the same point, nor directly from the East; but for the one half of the year, to wit from *April* to *November* or thereabouts, they come from the South-East, and for the other half of the year, *viz.* from *November* to *April*, they blow from the North-East. And these I suppose they call their Monsons and trade winds. Hence it is that they who sail from *China*, *Japan*, &c. to *Bantam* must wait the Northerly Monson which falls between *November* and *April*; and they who return from *Bantam* must go back again when the Southerly Monson comes, which is between *April* and *November*. And the Currents of the Seas are said to observe the same motion, and changes with the winds. I know not whether these Monsons do blow exactly from the same points in all parts, for it is like where there are *Bays*, highlands and *Islands*, &c. the Monsons may blow from different points; but this is chiefly to be understood of open Seas.

Now these Monsons I think may be easily accounted for from what has already been said anent the cause of the continual Easterly winds between the *Tropicks*; for seeing the lessening of the *Air's* pressure under the Line, and the pressure of the Neighbouring parts of the *Atmosphere* thereupon occasion these continual *Brieses*, if the *Sun* were constantly in the *Æquinoctial Line*, it is like the wind would blow still directly from the East, but in that he is the one half of the year on the one side of the Line and the other half on the other, there must of necessity follow a change of these *Brieses* into stated Monsons. For imagine the *Atmosphere* to be divided into two equal *Hemispheres* by the *Æquinoctial Plane*, if the *Sun* were always in the *Plane*, there would be still an equal pressure from both these *Hemispheres* upon the *Air* under the Line and the *Brise* should be directly from the East. But now when the *Sun* comes on the North side of the Line as far as the *Tropick of Cancer* and back a-

C c c

gain,

gain, there is not an equal ballance, but the pressure of the Southern *Hemisphere* of the *Air* must needs be greatest, and consequently the *Briſe* must blow all that season from the South East, and when the *Sun* returns again to the South-ward of the Line as far as *Capricorn* and back again, the pressure of the Northern *Hemisphere* must needs preponderate and make the wind blow all that half year from the North-East. - And this seems to accord very well with experience. for their Northern Monſons are in our Winter season when the *Sun* is in the Southern Signs, and their Southern ones in our Summer when he is in the Northern Signs.

The fourth thing I have mentioned is the stated Winters and Summers, which are to be found in distant places of the same *Countrie* at one and the same time. For example the Rivers of *Indus* and *Ganges*, where they enter the *Ocean*, do contain between them a large *Chersoneſus* which is divided in the middle by a ridge of high hills which they call the *Gate*, which run along from East to West and quite thorow to the Cape *Comori*. On the one side is *Malabar*, and on the other *Coromandel*. On the *Malabar* side between that ridge of *Mountains* and the Sea, it is after their appellation Summer from *September* till *April*. In which time it is always a clear skie, without once or very little raining. On the other side the hills on the Coast of *Coromandel* it is at the same time their Winter, everie day and night yeelding abundance of rains; and from *April* to *September* it is on the *Malabar* side their Winter, and on the other side their Summer, so that in little more than 20 Leagues journie in some places, as where they crosse the hills to St. *Thomas*, on the one side of the hill you ascend with a fair Summer, on the other you descend with a stormy Winter. The like is said to be at Cape *Razalgate* in *Arabia*. And Dr. *Trapham* relates the same of *Jamaica*, intimating that there is a ridge of hills which runs
from

East to West thro the midst of the *Island*, and that the *Plantations* on the South side of these hills have from *November* to *April* a continual Summer, whilst those on the North side have as constant a Winter, & è contra from *April* to *November*.

From these and such like accounts it seems evident that a bare lessening of the *Atmosphere's Gravity* will not occasion rain, but that there is also needfull either a sudden change of Winds, or a ridge of hills to meet the *Current* of the *Air* and *Vapours*, whereby the *Particles* of the *Vapours* are driven together and so fall down into drops of rain. And hence it is that whilst the wind blows from the North-East, viz. from *November* to *April*, there are continual rains in the Northerly *Plantations* of *Jamaica* and on the side of *Coromandel* in the *East-Indies*, because the winds beat against that side of the hills, and so there is fair weather on the other side of these hills, in *Malabar*, and the Southern *Plantations* of *Jamaica*, there being no winds to drive the *Vapours* together. But in the Southerly Monson, viz. from *April* to *November*, *Malabar*, and the Southern *Plantations* of *Jamaica* have floods of rains, the wind beating against that side of the hills, whilst in *Coromandel* and the other side of *Jamaica* there is fair and clear weather. The Maps make those *Mountains of Gate* run South and North, and if so the Monsons must blow from other points by reason of the neighbouring *Countries* and *Islands*, or else this is not the true cause of these seasons.

This serves also to clear the next thing mentioned, viz. the singularity of seasons in *Peru* beyond any other parts of the Earth, and seems to be assign'd by *Acosta* as the cause of it. *Peru* runs along from the Line Southwards about 1000 Leagues. It is said to be divided into three parts, long, and narrow, which they call *Lanos*, *Sierras* and *Andes*; the *Lanos* or plains run along the South Sea Coast; the *Sierras* are all hills with some *Vallies*; and the

Andes steep and craggy *Mountains*. The *Lanos* have some ten Leagues in breadth, in some parts less and in some more, the *Sierra* contains some 20 Leagues in breadth, the *Andes* as much, sometimes more, sometimes less, they run in length from North to South, and in breadth from East to West. This part of the World is said to have these remarkable things. 1. All along the Coast in the *Lanos* it blows continually with one only wind, which is South and South-West, contrary to that which usually blows under the torrid *Zone*. 2. It never rains, thunders, snows nor hailes in all this Coast or *Lanos* tho' there falls sometimes a small dew. 3. Upon the *Andes* it rains almost continually, tho' it be sometimes more clear than other. 4. In the *Sierra*, which lies betwixt both the extreams, it rains from *September* to *April*, but in the other seasons it is more clear, which is when the *Sun* is farthest off, and the contrary when it is nearest. Now the reason of all seems to be this. The Eastern *Brieses* which blow constantly under the Line being stopt in their Course by the *Sierras* and *Andes*, and yet the same *Brieses* being to be found in the South Sea beyond *Peru*, as appears by the easie Voyages from *Peru* to the *Philippines*, a Current of wind blows from the South on the plains of *Peru* to supply the Eastern *Briese* in the South sea : and there being but one constant Gale in these plains, and no contrary winds, nor hills for it to beat upon, this seems to be the reason why the *Vapours* are never or very seldom driven into rain. And the *Andes* being as high perhaps in many places as the *Vapours* ascend in the highest degree of the *Atmosphere's Gravity*, this may probably be the reason why the Eastern *Briese* beating constantly against these hills occasion rains upon them at all seasons of the year. And the *Sierras* being it seems lower than the *Andes*, therefore from *September* to *April*, when the *Sun* is nearest, and so the *Atmosphere's Gravity* less, and the *Vapours* lower, they are driven against the *Sierras* into rain.

The

The last thing I shall offer to your consideration is a-
 nent those strong and lasting winds which usually fall
 out about the *Æquinoctials*, and that for any thing I can
 learn thro' all parts of the known earth. The causes
 of those particular, various, uncertain and unconstant
 winds which do blow in the *Countries* without the *Tro-*
picks, and that most frequently in *Mountainous* places and
 more seldom in great *Plains* such as *Poland*, I cannot so
 easily conjecture: but those general winds which usually
 fall out everie where about both *Æquinoctials*, seem to
 proceed from some general cause, and this I take to be
 the change of the *Monsons* and trade winds about these
 times between the *Tropicks*. For there must needs be
 about these seasons a change of the *Ballance* of the *At-*
mosphere according to what I have discoursed on the
 third head, and this I think cannot but occasion strong
 winds over all the Earth.

Thus, *Sir*, at the desire of the *Philosophical Society*, I
 have presumed to trouble both them and you with these
 farther Notes I had by me concerning Weather. The
 undoubted truth and certainty of all these *Phænomena*
 I cannot warrant; (most of them I had from *Purchas*
 his *Pilgrims*, whose Relations do not now pass for fabu-
 lous) far less can I assert my conjectures to be their
 true causes. I have proposed both only that I may
 give you occasion to employ your *Philosophical Cor-*
respondence on this subject also, and particularly
 to engage your acquaintances who go to the East or
 West *Indies*, to get particular and certain informa-
 tions of the stated Seasons between the *Tropicks* both
 as to winds and rains, &c, in the open *Seas*, the
Bayes, *Continents*, &c; and the particular situations
 of the *Mountains* as to the Quarters of the *Heavens*
 where those different Seasons are on their opposite
 sides; and that your Learned *Society* may continue to

[1156]

take this subject to their particular consideration, and you may be pleas'd to favour me both with your own thoughts and those of the Reverend Dr. *Wallis* on this head. I do by these present my most humble Service to your meeting and am,

Sir,

Your most Affectimate Friend

Aberdeen

and Humble Servant

Sept. 4. 1685.

GEORGE GARDEN.

Extract of the second Letter.

Sir,

THere have been two Monstrous births this year in this place, both *Females*: the first was two perfectly form'd Children above and below the belly, having two heads, four arms, and four legs, only the two arms which stood next other were not perfectly form'd into hands and fingers, the breasts beginning to joyn thereabouts; there was but one belly, tho' somewhat bigger than ordinary, one *Navel* and *Navel*-string tyed to one after-birth; yet there were four buttocks, two distinct fundaments, and the two privities were confounded together. 'Tis thought they might have been brought forth alive, but that they staid long in the birth, for that both heads presenting together, the *Midwife* thought they had been
Twins,

Twins, and thrust one of them always back. The other had all the due proportions of one Child, the head excepted; it having two heads, the one standing behind the other, the foremost less than the due proportion, and bowed down upon the breast having yellow hair, and wanting nothing of the due proportions of the face save one Cheek beneath the ey; the other bigger than ordinary, standing somewhat higher, having no face which they suppose to have been disfigured by the back part of the other. Neither of these were opened; the Mothers are alive. I had the account of the first from a *Physician* who was call'd to the Woman in hard Labour, and some women who were assistants; and the other from two *Midwives* who were present.

Upon the *River* of *Don*, a little below the bridge near the *River's* mouth, there is a bank, the face of which is broken down, and it is full of stones which one would think were in *feri*; they are all either round or oval, of different sizes; the faces of most of them are broken off, they are soft and will easily rub down with your hand, they are of different gritts and colours, and are made up of different sands and clays mingled together, the clay is soft both to hand and taste, in some of them white; in others gray, tho' in some places the clay and sand are hardened to the consistence & colours of such oval stones as we usually see in the fields, but where they are at the softest, the bed that each stone lyes in, is alwayes hard and of another gritt and colour. What light this may give to the *Natural History* of the formation of stones, I shall leave to the disquisition of others.

There are some things, which, tho' inconsiderable in themselves, yet, may have their own place in the *History* of *Nature*, and will not be unacceptable if they have not been taken notice of already; I shall only mention one or two of them relating to *Insects*. Mr. *Leewenhoeck* Numb. 94 and 97 of the *Phil. Transf.* was the first who
gave

gave notice of the five little Instruments which are on the head of the *Bee* before, four whereof are two pairs, the one being call'd by him scrapers, the other Arms, the fifth he calls the Wiper, supposing that by it they wipe off the honie from the flowers. This last is truly the Sucker or *Proboscis* being hollow and made up all of Circular *Fibres*, wherewith the *Bee* sucks the Honey from the flowers.

The *Globulets* which break forth from the Attire of flowers, describ'd by Dr. *Grew* and *Malpighius*, which are all for the most part of an oval figure and of different colours, some white, some yellow, some red, seem to be bags of Liquors and are the materials which the *Bees* carry in for their wax, as is evident not only from the different colours of the wax upon their legs according to the different colours of the *Globulets* of the respective flowers we see them light upon, but for that also if you take them gathering wax from any particular flower, and view a smal parcel of that wax with a *Microscope* you will find it to consist of the *Globulets* of the same flower, tho' it is not not so easie to discover what Liquor they make use of to cause them to stick together.

On the inner side of the hinder Legs of *Bees* on the joynt towards the toe, next to that on which they carry the wax, there are a great many rows of yellow sharp pointed stiff bristles, set all in order like the teeth of Combs for lint, which I look upon as the Instruments wherewith they break these *Globulets* and prepare their wax.

Aberdeen

Sir

Your Affectionate Cousen

and Servant

July 17. 1685.

GEORGE GARDEN.

Historia

*The Figures of some Antiquities; communicated by a
Member of the Royal Society.*

1. A Ring of Corinthian Brass with a Vizard of *Silenus* in a *Sardonix*.
2. An Amulet of the Gnosticks cut in a Chalcedonian, the names of certain Æones or Intelligences.
3. A *Tessera* of Chrystal having on one side XIII. on the other IΔ.
4. A *Fortune* and a half *Diana* in an *Onyx*.
5. An Ancient Picture of the *Virgin* in a Chalcedonian.
6. A *Cameus*, with a mixture of severall Gods.
7. An *Onyx*.
8. A Glass *Lachrymatory*.

*A Letter of Dr Lister's to Mr Ray, concerning
some particulars that might be added to the Or-
nithology.*

SIR,

IN answer to your kind Letter, I send you, what I designed for you some years since, viz. an *Abstract* of my Notes about *Birds*, which may be added to yours and Mr. *Willughby's History of Birds*, if you think fit; such as they are take them.

Fringilla montana major] *Sea Larks* nostris Aucupibus appellantur. Sc. in Agro Eboracensi sæviente Bruma sat copiose capiuntur.

Rubeculæ excrementa semper liquida sunt; etiam si illa ovorum luteis duriter coctis victitet; intestinis Cæcis
D d d caret,

caret, aut ea valde exigua & inutilia habet. Muscarum autem cortices & quæ ex id genus Victu facile coqui & eliquari in ventriculo non possunt; figura rotunda, pisorum in modum respicit.

Morinellus Anglo-nm] Hæ Aves bis in anno loca paludosa relinquunt & se in campos montosos gregatim recipiunt: Sc. *Aprili & Augusto*.

Transmigrationis autem causa ex Victu petenda est. Nam tum temporis aves quoddam Cibi genus ibidem reperiendum appetunt; ut autem id certo scirem, plurium Ventriculos dissecui, in quibus maximam partem Scarabæos quosdam minutos & nigricantes inveni; at inter alia & Costos & Cochleas Terrestres exiguas adverti.

Anserum ferorum 5 genera vulgo numerantur in agro Eboracensi satis frequentium (1) The little *Spanish Goose*, Sc. æque parvus ac *Brenta*, sed figura & colore quodammodo ad Anserem Domesticum accedens, ab Hispania denominatur. (2) The *Barnicle*, satis cognitus. (3) The *Scotch Goose*, Sc. Vulgatissimus feras, à Scotia ad nos, exeunte *Augusto*, adveniens, è quibus fere constant innumeri illi Greges qui in planis Campis (the *Woods* dictis) & alibi passim inveniuntur. (4) The *Whilke* Anser maximus niger, ineunte bruma primum adveniens; raro alibi quam in Pratis, pascuisque herba pascitur. (5) Anser Palustris noster, *Grey Lagg*, dictus; huic magnitudo Anseri Domestico subpar. Caput ex fusco nigricat, & ad medium Collum infuscatur; dorsum ex cinereo livescit; ipsæ autem Alæ, & earum remiges nigricant: Uropygium albescit, ejusque pennæ externæ albidæ sunt: Venter cinereus; is vero imus sensim fit niveus: Rostrum à Capite ad mediam fere partem nigrum, deinde subpurpureum, ipso ejus apice nigro; in superiore mandibulo non nisi unus denticulorum ordo, atque idem simplex ordo in inferiore; item huic lingua utrinque uno denticulorum ordine armatur. Pedes subpurpurei sive Carnei coloris, ungues fere albidii, excepto medii digiti, qui ex
majore

maiore parte nigricat. Pendet libras 7, & fere dimidium. In Paludibus Agri Eboracensis nidificant, ipsi & earum Pulli mense Maio pinguescunt, & in deliciis habentur.

Ad lanios ea Avicula referenda est, quam à *Germanis* *Silk-tail* vulgo appellari audio; harum unam aut alteram sclopeti glande transfixam, Eboraci, exeunte *Januario* *Anni* 1680 vidi. Sane perquam elegans Avicula est, magnitudine *Turdu* fere æquabat: huic in extremis Alarum pennis 4 aut 5 apices parvi coccinei nudi, *Cornei*, minime plumis vestiti; item in extrema cauda limbus latus, luteus instar corticis *Citri*, cætera maximam partem *Lanium* colore refert.

Hos lanios in *Prusia* frequentes esse ajunt *Mercatores* nostri.

Sir, I will not affirm the *Grey Lagg* to be different from the common *Wild Goose*: your Description and mine so well agree, save in the colour of the *Bill* and *Leggs*. The delign of the *Lanius*, I can send you done from the Skin.

I am, Sir, Your most Humble

Servant M. LISTER.

I have since viewed the Bill of the Bird called Silk-Tail at Mr. Charltons, and find it to want the notches in the upper part of the Bill proper to the Lanius kind. It must therefore be removed, and put amongst the Jay's.

See Dr. Lister's Figure of the *Silk-Tail* Fig. 9th.

*An Abstract of a Letter from the Learned Dr. Cole
Physician at Worcester, dated May the 13th.
1685, concerning Stones Voided per Penem.*

Sir,

IF the exclusion of two *Stones* (of the bigness *Fig.* 10, and 11) by the *penis*, without any, or any considerable pain, be worth notice, be pleased to know, I had the account of it from the person that Voided them. I saw the *Stones* and took the bigness, and circumference, (of which the strait line is the measure, they being in the thickest part much of a bigness) of them, by tracing lines about them as they lay upon a paper for the shape, and measuring them with a thread for the circumference. He told me he was for many years subject to great pain, first in the *Kidneys*, and afterwards in the *Bladder*, when that in the *Kidneys* ceased. But since their exclusion (which was about a year since) he was free from pain till the time I saw him, which was (as I remember) about half a year since.

JOHANNIS HEVELII, *Consulis Dantisca-*
ni, Annus Climactericus. *Gedani* 1685. in
Folio. *Wherein (amongst other things) he vin-*
dicates the justness of his Celestial Observations,
against the exceptions by some made to the accuracy
of them.

IT is Learned, Accurate, and Diligent *Astronomer*, in
his *Dedication* and *Preface*, (and elsewhere occa-
sionally in the Book,) doth bewail the great Calamity
he suffered by Fire, in the year 1679; wherein (*Sept. 26*)
in.

in a few hours, his Houses (seven in number) with all therein (his money, plate, gold, Silver, and all his household goods, his Printing-houses, with the furniture thereof, and great part of his Library; and the remaining copies of all his printed works set forth at his own charge from the year 1647 to 1679,) and particularly his dear *Urania*, and all its Observatories, with all his Instruments, *Astronomical* and *Optical*, (described in the former part of his *Machina Cœlestis*,) and many other things of great worth, were in a manner wholly consumed, and turned to Ashes and himself well nigh deprived of all.

And doth withall complain of the unkindness of some whom he had taken for friends; who, instead of pitying his Calamity or assisting him therein, did rather insult over it (or tacitly please themselves therein,) and, by giving him new troubles, added to his affliction,

But acknowledgeth and gratulates Gods goodness; that (before this Calamity) he had (the same year) finished and published the latter part of his *Machina Cœlestis*, containing the observations of almost fifty years; (which are thereby preserved :) That some of his Papers, (particularly his new *Catalogue* of the fixed Stars,) were strangely preserved from the fire: And, that (without being wholly despondent) God hath yet given him life and courage, to resume his former studies, to rebuild his Observatory, and furnish it with necessary Instruments (though much inferiour to those incomparable ones that perished by the fire;) and to apply himself to deduce a-new (from their first originals) much of what he had written (which was wholly destroyed) relating to his *Prodromus Astronomiæ*, his *Correction of the Tables*, his *Uranographia*, and his new *Celestial Globes*, which he hopes (through Gods assistance) in a short time to fit for the publik.

This piece (the first by him published after that dreadful Conflagration) he calls his *Annus Climactericus*, as

being the *Forty ninth* year of his observations, (49 being 7 times 7;) and because of that great revolution of affairs which in that year did befall him; the beginning whereof, and the greatest part of it, being much to his content, but the end of it so sad and dismal.

Amongst the happinesses of that year, he reckons, first, his finishing and publishing the latter part of his *Machina Cœlestis* (containing the observations of 48 years.) And then, the coming of Mr. *Hally* to him at *Dantzick*, and abode with him for some months; and the great satisfaction he received therein. Having, before, much desired, that some from the *Royal Society* at *London* (acquainted with the way of observing there, by *Telescopick Sights*;) might come to him to *Dantzick*, to view the manner of His observing, (by plain sights, and the naked Ey:) Who having thus been an Ey-witness of both ways might satisfy that *Society* of the comparative goodness of both; at least, that His way of observing was not so despicable, as might by some be thought or be pretended. And the great satisfaction that Mr. *Hally* did (much beyond his expectation) there receive, the *Author* looks upon as a great happiness. And, that this happened before that dismal destruction of his Observatories and Instruments: (for, after that, it would have been impossible :) And, that the Observations then made (in Mr. *Hally's* presence, and with his assistance,) were wonderfully preserved from the fire, wherein so many of other things perished.

Forthere had (divers years before) happened a controversy between Mr. *Hook* and him (and divers letters passed thereupon) concerning the excellency of *Telescopick Sights*; which Mr. *Hook* did much prefer before the *Plain Sights*; used by *Tycho*, by the *Landgrave*, by all observers heretofore, and by this *Author*. As if it were not possible, with these *Sights*, (be the Instruments never so large or accurate,) to make Observations nearer
then

then to Two or Three whole Minutes: But himself could, with *Telescopicke Sights*, (by an Instrument but of a span breadth,) make observations, Thirty, Forty, Fifty, yea Sixty times more accurate, than could be done the other way with the most Vast Instruments. And, upon the *Authors* publishing that first Part of his *Machina Cœlestis* (wherein all his Instruments are accurately described) Mr. *Hock* published his *Animadversions* thereon; with much more of bitterness and boasting (as this *Author* thinks, and others also whom the *Author* cites,) then there was reason for. Which he thinks was done out of design to disparage Him, his Instruments, and his Observations (unsight and unseen,) and to prepossess others with mean and slight thoughts of them, (even before they were yet published;) and a high opinion of himself who (with so little charge and so small Instruments) could do things so much more accurate than had hitherto ever been done, by any: thus seeking to raise his own reputation by disparaging what is done by others, in things wherein himself doth nothing.

The *Author* thinking the Credit of his Observations (and consequently the Benefit which the Publike might receive from them) to be herein much concerned; (for, if they were not to be trusted or relyed upon, with more accurateness than with the latitude of two or three minutes, they would fall much short of what the world expected from them:) he complained hereof in his Letters to divers learned men, and particularly to those of the *Royal Society*, desiring that right might be done him in this point. For that a difference of this nature, was not to be determined by conjectural speculations which a man may project to himself, who brags only what great things he can do, but doth nothing:) But by Practick experience, and Trials actually made both ways; and these duly examined and compared by persons competent to judge of such matters.

For

For there be advantages, and disadvantages, in both ways; which may, by sharp words, be aggravated to a great height; while yet, whether of the two, upon the whole matter, is to be preferred, cannot be otherwise determined than by experience.

And in order hereunto, the *Author* had again and again desired, with earnestness, that Mr. *Hook* would vouchsafe to give him (at least) these eight Distances, observed by his Instruments (great or small, as he pleased,) to be compared with the same observed by this *Author*. Namely, 1. *Lucidæ Arietis, à Palilicio*; 2. *Hujus à Polluce*; 3. *Pollucis à Regulo*; 4. *Reguli à Spica Virginis*; 5. *Hujusque à superiori in manu Serpentarii*. 6. *Hujus ab Aquila*; 7. *Hujusque à Marcab*; 8. *Atque hujus demum à Lucida Arietis*: But could never obtain from him either these or any other. Though it had been no hard request to grant it, if Mr. *Hook* could (as he tells us) perform according to his method) 100, yea 200 Observations in one night.

He had from *Bullialdus*, *Buratinus*, *Fullenius*, and others, who had been Ey-witnesses of his observations, and assistant at them, great attestations of their accurateness: Others who had not so been present, had yet a great esteem for them, notwithstanding the exceptions made to them by Mr. *Hook*; blaming his censure as undeserved and too severe: And others even of those who had a great opinion of *Telescopick Sights*, and did themselves make use of them, had yet a far other opinion of his Instruments and Observations, than what had been expressed by Mr. *Hook*; And thought at least this demand of his, very reasonable, That it might be free for either to make use of such Sights as themselves thought best, or were best acquainted with, without taking upon them to prescribe to others (over whom they had no Authority;) or to reproach and vilify them because not of the same opinion with themselves. All which matters of fact are made to appear by divers Letters there printed, which
had

had passed between him and other learned men on that subject.

But he had further desired (for the greater satisfaction of all) that some one or other might come over to him, from the *Royal Society*, (well acquainted with the Method of observing by *Telescopick Sights*,) who might (upon his own view of the *Authors* Instruments and manner of observing, and by comparing those with his) satisfy himself; and report to the *Society*, for their satisfaction, what himself by experience should find true; and whether there were indeed such cause of complaint as what Mr. *Hook* had made.

Agreeably to this desire of his (which he recounts as a great happiness) Mr. *Edmund Hally*, a Member of the *Royal Society*, who had a very good opinion of *Telescopick Sights*, and was himself accustomed to use them, and had (a while before) made a Voyage to the *Isle* of *S^t. Helens*; and there (with such) made observations of the Fixed Stars in the Southern *Hemisphere*, (many of which are to us unseen,) whereof he had then lately published an account in Print; did, from the *Royal Society*, arrive at *Dantzick*, May 26. 1679. and there continued, with the *Author*, till July. 18. and was all that time a constant attendant at his observations; and had with him (of his own) a very good Instrument furnished with *Telescopick Sights*; the better to compare thereby the one and the other way of observation.

The same day that Mr. *Hally* arrived (May 26. 1679) he did, in Mr. *Hally's* presence (as a specimen of his manner of observing and the accurateness thereof) take (with his large brass *Sextant*) the Distance of *Regulus* and *Spica*; (Mr. *Hally* having so desired, as doubting whether he could, in his presence, determine to a minute, the same distance which he might have possibly, some time before, observed:) Which (notwithstanding the disadvantage of the light Summer-nights, and

the *Moon* then shining) he found to be 54° . $1'$. $55''$. the same exactly, even to seconds, which he had, before, six times observed in the years 1658. 1661. 1671. Whereat Mr. *Hally* being much surpris'd, (as not expecting that accuracy,) it was again for his greater satisfaction (that he might not think it only a great good-hap) observed the same exactly, *June*. 1. and again *June*. 7.

Many more observations were made from day to day, during all the time of his abode there, such particularly as Mr. *Hally* (for his satisfaction) did direct. To which he attended constantly, and did strictly examine them, with great diligence and curiosity; that he might not by any mistake be impos'd upon. Which observations are all, here, particularly sett down. And amongst the rest, (to compare the accurateness of the two sorts of *Sights*,) a list of divers observations made by the *Author* (with a small Instrument and common *Sights*,) and the same made by Mr. *Hally* (with a much larger and *Telescopick Sights*;) By which the *Author* thinks it will be evident to an indifferent Judge, that those performed by the Plain *Sights*, (though in a smaller Instrument,) are the more accurate. And doth seriously profess, that he could not with Mr. *Hally's* Instrument (though he did truly endeavour it) make observations with that accuracy and that readyness, as with his own.

Upon the whole matter, Mr. *Hally* finding all much to his satisfaction, and beyond his expectation, thought fit to leave in writing his Attestation thereof, (in form of a Letter to the *Author*, dated *July*, 8, 18, 1679.) wherein he declares himself abundantly satisfied of the use and certainty of these his Instruments and Observations, And whereas he had, before been always doubtful, that his observations by naked *Sights* might, as to some Minutes, be uncertain; and had therefore wondered why he declined the use of *Telescopick Sights*; (though
yet

yet he was loth to call in question the truth of them, but preserved always a just veneration for them:) He had, (partly to gratulate the Authors publishing of his observations, and partly to satisfy his own scruples,) undertaken that journey; which he now looks upon as no small happiness; and declares himself abundantly pleased with it. And offers himself a voluntary witness, (of the almost-incredible certainty of those his Instruments,) against all who shall for the future call his observations in question. As having seen, with his own Eys, not one or two, but a multitude of observations of the fixed Stars, performed with his great Brass Sextant, (even by divers Observers, and by himself sometimes, though less expert therein,) being again and again repeated; most accurately, and almost incredibly to agree; and never to differ more than by an inconsiderable part of a Minute. With further expressions of Joy, and Admiration; as wondering at nothing more, than to find them so accurate.

The Author being by these Observations, confirmed in his resolution of adhering to Bare Sights with his Naked Ey (without glasses;) and having satisfied Mr. Hally as to the Certainty and Accurateness thereof (far beyond what Mr. Hally could expect;) thought fit in the first place (after his *Machina Cælestis*) to publish these (for the satisfaction of others) to preserve the just reputation of his observations before published, which Mr. Hook had endeavoured to render suspected.

He therefore gives us first, his observations of the year 1679. beginning from Jan. 8. St. n. (where his *Machina Cælestis* ended;) and so onwards till May 26, when Mr. Hally arrived. And therein (amongst others) the Transit of some Stars, and the Occultation of some others, by the Moon: Mar. 25. Mar. 30.

From thence to Jun. 18. we have an account of all his observations made together with Mr. Hally, with the success thereof. And (amongst the rest) of the oc-

culturation of *Jupiter* by the *Moon*, (a case that seldom happens) *Jun. 5.*

And thence to *Sept. 26.* (the fatal day when his observatories with all their furniture were destroyed) which concludes the observations of that year.

After these observations, of the year 1679; are 27 Letters which had passed between the *Author* and divers other learned men, relating to the controversy between him and Mr. *Hook*, about the use of *Telescopic Sights*.

The First, Third, and Fifth, are from Mr. *Henry Oldenburg*, Secretary to the *Royal Society*; and contain (beside some other things, declaring the *Society's* great respect for the *Author*,) Mr. *Hook's* description of his *Telescopic Sights*, with his reasons urging the use of them, Affirming that, for any Celestial observations, an *Instrument*, with these, though but of the *Radius* of one Span, may be made more exact, than, with common *Sights*, the best that can be made, though of three-score foot *Radius*. That, whereas the naked *Eye* can hardly distinguish an angle of a Minute, it may thus distinguish a single Second.

The Second, Fourth, Sixth, and Seventh, are the *Authors* answers to those; maintaining the contrary. Not thinking it possible, that so small an *Instrument* can do such great things; and that, with his own, he can distinguish a much smaller angle than Mr. *Hook* will allow. Appealing to experience (which is to be the judge in this case:) and desiring (for instance) Mr. *Hook's* Observations, (by his *Instrument*) of Eight distances proposed; to be compared with his own Observations of the same; that it may be thence judged, whether are the more exact. (But could not obtain any one.) And he believes that those who thus commend these, if they had ever made trial of such large *Instruments*,

uments, at least continually for some considerable number of years; and were with such small ones to attempt (not one or two single distances, but) the Retitution of the fixed Stars as himself hath done; they would be of another mind. But (leaving them to enjoy their own opinion) desires at least it may be free for him to use his own way, wherein he is confirmed by the experience of so many years; and from which he hath many reasons why not to depart.

The 8th. from M. *Ismael Bullialdus*; and the 9th. from *Bernhardus Fullenius*, (a Dr. of Law, and Consul of *Franeker*,) are gratulatory Letters upon the Edition of his *Organographia* and his Instruments therein described; highly commending them, and the great accuracy of the Observations made thereby (of which both of them had been Ey-witnesses, and esteem it a great happiness so to have been;) and with so great exactness (within less than 6 Seconds) as, without having seen it, they could hardly have believed. And, the latter of them (upon occasion of an Observation published by Mr. *Hook*, aiming to prove a Parallax of the Earths Annual Orb;) declares his suspicions of the uncertainty of *Telescopick Sights*, preferring others before them.

The 10th. is of the *Author* to D. *Fullenius*, complaining of Mr. *Hook*'s unhandsome usage of him in his *Animadversions* on the *Authors Organographia*, or first part of his *Machina Cælestis*, (then newly come to his hands:) As making it his business, to carp at all his Instruments, and render them suspected; to blacken and disparage to the Learned World, all his Observations; (which yet he had never seen, nor could see.) As That his Instruments are not larger than *Tycho*'s, nor his Divisions better, nor his Observations more accurate. That 'tis not possible with those Instruments and the naked Ey, to discern an intire Minute, or determine to a Minute either Altitudes or Distances. And

doth in a manner, from step to step, carp and cavill at all and every thing. Boasting, that himself can perform all by a very small Instrument, with *Telescopick Sights*, Thirty, Forty, yea Threescore times more exactly: (while yet he hath not, that this *Author* knows of, ever published to the world any one considerable Observation performed by himself.) Concerning which this *Author* appeals to the judgement and experience of this his friend (who had often seen the practice of it) whether he could not clearly distinguish *five Seconds*; even without the use of Diagonal lines (as Mr. *Hook* pretends, and cavils at it.) And whether he can imagine that Mr. *Hook* can with an Instrument of one Span (so instructed as he describes) perform things Fifty, or Sixty times more exactly, than he with his of 6 or 8 foot Radius. And, what difference he thinks there may be between the parts distinguished by Diagonal slope-lines (cutting the Arches of Concentrick circles) and those of the same Arches by streight lines from the Center, (which this *Author* also there useth; leaving it indifferent to judge, either by the one or the other, as the observer pleaseth.) But wonders that Mr. *Hook*, who hath never yet performed, or so much as attempted, any thing in this kind; should take upon him thus to censure others. Thinking that it more becomes learned Men, not to boast of what they *can*, or *will*, or *mean* to do, but rather to let the world know what they *have* done. And when Mr. *Hook* hath performed things so much more accurate, it will then be time to tell the World what they are.

The 11th. is a letter of his, of like complaint, to Mr. *Oldenburgh*; Adding moreover, that Mr. *Hook* should rather have written his Animadversions in *Latine*, or gotten some body to put them into *Latine* for him, (as for those formerly concerning M. *Auzot*,) and not put those (that are not perfect masters of the
English

English tongue) to the trouble of getting them translated: That he is sorry to be putt upon a necessity of wrangling, and empty words, (not because he thinks it hard to answer what Mr. *Hook* objects, but because it is contrary to his inclination, and will take up time which might be better imployed,) this being a matter not to be decided by empty words and altercations, but by experience and practise. That himself useth, in his own studies, to mind rather his own business than that of others; without prescribing to others (Dictator-like) what steps they must follow, and impose on them his own methods and contrivances, as absolutely the best, safest, and subtlest, of all that may ever be invented by any man: whereas Mr. *Hook*, he finds, more inclined to meddle with others business than with his own; and rather to find fault with what is done by others, than to do any thing himself. That he makes it his business to perswade him and all the world, that his own way is the best, safest, and most exquisite, which ever can be invented by any; reproching this *Author* all along for not obeying him and following his dictates, (as if this *Author* were one under his command;) Bragg- ing only of what he can do, but doth nothing. That he thinks it would better become Mr. *Hook*, to suspend his judgement a while till he have taken time to examine (or at least to see) what is done by others; before he talk at this rate of all that is, or hath been, or ever shall be done in the world: while, in the mean time, he requires of others to give credit to what he says of his own Observations; before they can be seen, and examined, or even made. That if this *Author* (who without stipend or publike salary, without being hired or maintained to that purpose at the charge of others, without any duty or obligation upon him thereunto, other than his own inclination to these studies, and his willingness to serve the publike, hath, at his

his own charges, with the expence of so much time and labour, done what he was able, and with good intention, and so much more than Mr. *Hook* either hath done, or is ever like to do,) hath deserved to be thus slighted, scorned, and contemptuously exposed, almost in every page, (because he had not recounted Mr. *Hook* in the number of his cheif Fautors and Patrons;) yet the Noble *Tycho*, the Illustrious *Landtgrave*, or some others, (who are all equally concerned in his censures) might have been thought to deserve better; who will certainly be found, if not in all things (for the best are liable to mistake sometimes) at least in some things, to have performed better than Mr. *Hook* is willing to allow them. However, this he hath to say for himself, that neither Posterity, nor any of his Superiors, can say, that he was bound in duty to do more than he hath done. And, as to the unprofitable and useless charge, of which Mr. *Hook* so often speaks ironically and with contempt (as he doth also in his other seeming commendations,) it came not out of Mr. *Hook's* treasury (that he need be concerned for it) and which will appear (the *Author* hopes) not to have been altogether in vain. That they who like not his Observations, may look by them, and wait for better, or make better themselves. That the purblind or short-sighted, may (if they please) make use of Spectacles and Perspectives; but himself, while his Ey-sight serves, shall chuse to make use of his bare Ey, and naked Sights. That it is free for Mr. *Hook* to make use of what Sights he pleaseth, (or none at all,) and to Observe (if he can) to the niceness of a single Second (of which yet the *Author* doth much doubt) and perform Sixty times more accurately than *Tycho*, the *Landtgrave*, this *Author*, or any other hitherto: but doth not own him, as his Prince or Dictator; nor will suffer himself, by his empty words to be perswaded out

out of his own senses, and the experience of so many years. But he is satisfied in this; that, what Mr. *Hook* slights and undervalues, is by divers eminent, worthy, and learned men, well approved and commended; (who's praise he more values, as being from praise-worthy persons;) and doubts not but that they will be found more accurate than to one, two, or three intire Minutes (as Mr. *Hook* pretends, before he sees them) And hopes that, of the *Royal Society* (of whom he expresseth a great esteem) there are who will be ready to vindicate him from Detractors.

The 12th. is from Dr. *Wallis*, to the *Author*, the 19th. to him from *Titus Livius Burattini* (which latter had for some time been with the *Author*, and assistant at his Observations;) which (beside Gratulations, and just commendations of his Instruments, and his Observations) speak particularly of the Divisions in the limb by *Diagonals* (used by *Tycho*, the *Landgrave*, this *Author*, and divers others;) to this purpose: That, the Division of an *Angle* into equal parts by streight *Diagonals* obliquely cutting concentrick Arches in the limb, would require, in Mathematical rigor, that the concentrick circles be set at somewhat unequal distances; and in smal Instruments, where the breadth of the divided limb is a considerable part of the Radius, (as $\frac{1}{5}$, or $\frac{1}{10}$ thereof) and the Angle to be so divided, of a considerable greatness (suppose, 10 minutes or more) it may require some little difference of intervals; (as the *Author* was well aware, and had himself given notice *Mach. Cœlest.* p. 139, 140,) But where the Instrument is large (as here, 6, 8, or 10 foot Radius,) and the breadth of the limb to be divided, but narrow (as here, about half an inch,) and (as here) the angle to be so divided but 5 minutes; the true intervals according to Mathematical rigor, are undistinguishable, to the subtlest sense, from equal distances. And, here, it is indifferent to

say, These intervals are such as by calculation they ought to be; or to say, The circles be equidistant: For no sense can distinguish the one from the other. And if there had been any difference; the *Author* had sufficiently provided for it, by performing the same divisions by straight lines from the center also.

The Computation (of Dr. Wallis) to which the Letter refers (the Method whereof is to be seen at large in the Philolophical Transactions Numb. III.) is to this purpose. See the Figure 12.

Take me (for instance) his large brass Sextant (which is one of the Instruments which he did most frequently make use of,) where A, the Angle (at the Center) is 5 Minutes, to be divided into 5 equal parts, by a Streight Diagonal, obliquely cutting (in the Limb) 6 Concentrick Circles; (the length of the Ray, to each of which, we are to enquire.)

The Radius of that Instrumēt is (more than) 6 foot: and the breadth of the Limb (cutt by the Diagonal) is somewhat more than half an Inch; that is, somewhat more than $\frac{1}{14}$ part of the Radius.

We will allow it to be at least $\frac{1}{15}$ part of the Radius, (or even somewhat more than so:) and, accordingly, O, the Obtuse angle at the Base (contained by the Diagonal and the shortest Ray, or that of the In-most Circle) 172 degrees: And therefore V, the Acute angle at the Base,) contained by the Diagonal and the Longest Ray, (or that of the Out-most Circle,) will (because of A, at the Center, of 5,) be $7^{\circ}, 55'$: And that at the Second Circle (next to it) will (because, here, $A = 4'$.) be $7^{\circ}, 56'$: And, at the third, $7^{\circ}, 57'$; And, at the fourth, $7^{\circ}, 58'$: And, at the fifth (which is next to the In-most) $7^{\circ}, 59'$.

Then (by that Case of Trigonometry, where, The two Angles at the Base being Given, with a side Opposite to one of them; we are to Find that opposite to the other:)

other :) *it is*, As the Sines of the respective angles V, (in the several circles,) to that of the Angle C : so the shortest Ray (opposite to V,) to the respective Rays, in the several Circles.

That is; putting 1, or (1, 00000,) for the Ray of the In-most Circle; the rest are thus found;

Angles :	Sines	172, or, 80, 0'. Shortest Ray,	1,00000	Differences,
7°, 59' :	1388850.	1391731 :: 1,00000	1,00207 $\frac{1}{2}$ -	.00207 $\frac{1}{2}$ -
7, 58 :	1385970.		1,00415 $\frac{1}{2}$ +	.002 84
7, 57 :	1383089.		1,00625 -	.002 9 $\frac{1}{2}$ -
7, 56 :	1380208.		1,00835 -	.002 10
7, 55 :	1377327.	Longest Ray,	1,01046 -	.002 11

Where (the computation being made as accurately as the common Canon of Sines will permit) the Differences of Rays; that is, the Intervals of the Circles; are so near to equals, as not to differ more than by an Hundred-Thousandth part of the (shorter) Radius. (The breadth of the limb, that is, the difference of the shortest and longest Ray, being somewhat more than the Hundredth part of the shorter Ray.)

That is (supposing the shorter Ray to be 6 foot, or 72 Inches,) the difference of Intervals between the concentrick Circles is not past $\frac{72}{100000}$ of an Inch. (Which is about one fourteen-hundredth part of an Inch.) Which no sense can distinguish from equidistants.

The 13th. from *Ismael Bullialdus* (who had himself also been a Ey-witness and Assistant at the *Authors* Observations, for some considerable time,) testifies his great resentment of Mr. *Hook's* dealings herein; as being astonished to see how far envy and a spirit of contradiction can transport a man. And thinks it a duty which the *Author* owes both to his own reputation, and to the publike, to vindicate himself and his observations from these aspersions. But thinks he cannot do it better

then by hastening the publication of them [*which since is done*] the sight of which will be so great a satisfaction to all equall judges, who understand (though but a little of) these affairs, that there will need no further apology.

The 14th. 15th. 16th. and 17th. are Letters which passed between Mr. *Flamsted* and the *Author*; discoursing the reasons why the one chooseth to make use of *Telescopick Sights*, and the other of *Plain Sights*: with some Observations imparted from each to other, and disquisitions thereupon. Mr. *Flamsted* excuseth some doubts he had, formerly, conceived about the uncertainty of this *Authors* Observations, even to One, Two, or Three Minutes. Which he acknowledgeth, upon sight of his *Organographia*, are in good measure satisfied. And the *Author* hopes he will be yet more satisfied, when he shall see the whole body of his Observations. Not that he pretends always to observe exactly even to seconds, or that he is not liable sometimes to commit an Error, (as all men sometimes are, because but men, whatever *Sights* they use; and of which there is instance in the few Observations that Mr. *Flamsted* imparts;) but that, when something of accident doth not interpose (and he mentions many which may a little disturb an Observation,) he can clearly distinguish five seconds, or even less than so; and when some Observations chance to be a little erronious; they may be discovered and corrected by those that are more exact.

They both agree that *Tycho's* Catalogue of the Fixed Stars wants Rectification. The Errors of which, Mr. *Flamsted* thinks to have proceeded from *Tycho's* using *Plain Sights*; the *Author* ascribes them rather to his trusting to several Scholars of his, to make many of his Observations; some of whom were either not so skillful, or not so carefull, as some others were; either in making the Observations, or noting them down, or computing from them: On which account it is (he thinks)

thinks) that the *Hassian* Observations are in many things more accurate, (though they used the same kind of *Sights*,) than those of *Tycho*; because, there, the Observations were constantly made by *Rothman* and *Brig*, two diligent men.

The 20th. is of *Bullialdus* to the *Author*, returning thanks for imparting a copy of his letters to Mr. *Flamsted* (as at Ep. 13. for that of Ep. 11. to Mr. *Oldenburg*;) concurring with him therein; esteeming the use of glasses, less certain (because of the uncertain refractions) than *Plain Sights*.

The 21st. and 22^d. from Mr. *Oldenburg*, testifyeth, from the *Royal Society*, their continued esteem of the *Author*, and of his studies and labours, notwithstanding the artifices of some to the contrary; and that they were not privy to Mr. *Hook's* publishing his *Animadversions*. Giving a more fair character of Mr. *Flamsted*.

The 23^d. of the *Author* to Mr. *Oldenburg*, signifyeth, that he is not displeased with Mr. *Flamsted*, (or others,) for using Glasses; which he allows in many cases (especially to those who are short-sighted) to be of good use; and commends in particular the Micrometer as an excellent Instrument for small distances. But desires that they will, without offense, permit him to use (what he finds best) *Plain Sights*. Which (where his Eyesight serves) he thinks much better: And, if he were now to begin that great work, of restoring the fixed Stars (about which he had been so long employed) he should take the same course as hitherto, by using *Plain Sights*. Wishing, that some of those who are so fond of *Telescopes*, were with him to discourse the matter, and see his Observations; and he beleeves they would then be of another mind.

The 25th. from the *Author* to Dr. *Grew* (then Secretary to the *Royal Society*, after the death of Mr. *Oldenburg*,) and the 26th. to *Pethleus Cluver*; signify the ar-

rival of Mr. *Hally*, with which he was very well pleased; having long desired, that he might have opportunity of conversing with some, well acquainted with *Telescopic sights*, that so he might, not by words only, but by experience and precise, evidence to them the convenience and certainty of his Observations by *Plain Sights*. That Mr. *Hally* had now (for about a months time) diligently observed together with him, every fair night; That he was already well satisfied upon his own experience (and would, he hoped, signify so much to the *Royal Society*) that he found, upon tryal, things far otherwise than had been suggested by some (as if he could not, with his Instruments and naked *Sights*, distinguish to one, two, or three Minutes.) But intimates, that himself was not so well satisfied with Mr. *Hally's* Instrument with *Telescopes*; (having found, upon tryal, the suspicions true which before he had of them :) And is very well pleased, that he had not been prevailed with, to exchange his *Plain Sights* for such. And with it, he transmits to the *Royal Society*, his late Observation of the occultation of *Jupiter* by the Moon.

The 27th. (which is the last,) is from Mr. *Hally* to the *Author*; testifying his great satisfaction with the *Authors* entertainment; With the opportunity of conversing & observing with him; With his Instruments and accurate Observations, far beyond what he could have imagined; And offers himself ready to testify (against any who should hereafter question it) the great accurateness thereof (wondring at nothing more, than to find them so accurate,) and of their great agreement one with another; not varying more than by an inconsiderable part of a minute.

Now the distinguishing of 5", (which is actually distinguished in these Instruments,) is so nice a matter as answereth, upon Earth, to the twelfth part of an English mile
(allowing

(allowing 60 miles to a Degree of Latitude;) or the third part of a quarter of a Mile. Which is so nice, as that, whereas we are wont to enquire, what is the Poles Altitude at London? what at Paris? what at Dantfick? and so forth: This is much the same as to enquire, what it is at Charing-Cross? and, what at White-hall Gate? (Supposing them to be distant Northward, one from the other, $\frac{1}{4}$ of an English Mile, or 440 foot,) or (because Degrees of Longitude; are, in the lesser Parallels, less than degrees of Latitude) much the same as to enquire, what a-clock it is at the East-end? and, what at the West-end, of the Abby-Church in Westminster?

The 18th. and 24th. from the Author to Mr. Oldenburg, are of another subject. Being a Continuation of the History, of the *New Star*, in the Neck of *Cetus*; which hath been observed sometimes to appear, sometimes to disappear, and then return again, and with very different degrees of light; as likewise of two such others in *Cygnus*, (one in the Breast, the other under the Head.) He had formerly (with his *Mercurius in Sole*, published in the year 1662) given an account of it from the year 1638 till that time. Which here he continues from thence to the beginning of the year 1677; and then again to the end of that year. And then again (after all these Letters,) from the beginning of 1678 to the destruction of his Observatory in 1679; and (after some intermission for that reason) from 1681, till toward the end of 1683.

Having dispatched what properly concerns his *Annus Climactericus*, and the Letters relating thereunto: He gives us the Continuation of his Observations since that time.

He begins with that of the *Comet*, (but without an Instrument, having lost all,) Dec. 2. 3. 4. (new stile) 1680. while it was Matutine (before the Sun-rising:) and

and then (according to his expectation) when it began to be Vespertine, *Dec.* 24. and so onward. Bewailing himself that he could not, as heretofore, with large Instruments, and long *Telescopes*, observe this so remarkable a *Comet*.

Jan. 1. 1681. (*New Stile*;) he observed the occultation of *Palilicium* by the *Moon*.

And *Jan.* 2. and so forward, (having now gotten a small Instrument) proceeded (as he could therewith) in the Observation of the *Comet* with his Remarks upon it.

In *August* following he had re-built his Observatory, and gotten some Instruments, (but much inferiour to what he had lost.) Where his first Observation was an *Eclipse* of the *Moon*, *Aug.* 29. 1681. *ft. n.* And, after that, another very great one, *Febr.* 21, 22.

Then the Observations of another *Comet* 1682. With many others, of the Fixed Stars and Planets. And amongst the rest, the great Conjunctions of *Saturn*, *Jupiter*, and *Mars*; And a Transit of *Jupiter* by the *Moon*, observed (in the day time) by a *Telescope*, *Nov.* 21. 1682. *ft. n.* with many other *Transits* and occultations.

After which is a succinct account or History of the three great Conjunctions of *Saturn*, *Jupiter*, and *Mars*, in the years 1682, 1683.

Then the Observations of a Third *Comet* 1683, with the History of it. With several *Transits* and Occultations.

He tells us of a Fourth *Comet* observed by *Blanchinus*, at *Rome*, in *June.* 1684, (but not, that he hears of, by any body else,) at a time when himself (by indisposition of body) was not in a capacity of making Observations.

But he wonders how those of *Lipsich*, should not see this *Comet*, who pretend (about the same time) to have been the first discoverers of the *Nine* small Stars, under the

the feet of *Bootes* (which they have formed into a new Constellation called *Gladii Lipsiensis*) just about the place where this *Comet* passed. Which Stars are no other than some by himself long since observed, and to be found (by other names) in his New Catalogue of Fixed Stars; and the Observations of them, published (amongst others) in his *Machina Cœlestis*. (Which, he doubts, could not by them, at that time, be all seen.)

On which occasion he takes notice also of *Two Schemes* of those in the *Moon*, published as his own by *Pere Cherubin*, (*Observations faites par le Pere Cherubin d'Orleans Capucin*) which are but copied out of the *Authors Selenographia* pag. 222. 262.

He concludes with an Observation of the *Suns* Eclipse, *July. n. St. 12. 1684.*

A Course of Chymistry: by Nicholas Lemery; M. D. Translated from the Fifth Edition in French, by Walter Harris, M. D. Fellow of the College of Physicians. London 1686.

THE *Chymistry* of Monsieur *Lemery* is of such reputation in the World, that Notice of additions to it can't be thought ungratefull to the Reader.

This Edition is not only adorn'd with several Tables of Figures, representing the *Supellex Chymica*; but is also enlarged by the access of divers operations; as particularly the Pulverisation of *Tinn*, by casting it,

G g g

when

when melted in a Crucible, into a round wooden box, which has been whitend with Chalk on all sides within; then covering the box, and presently shaking it about, until the *Tinn* is become cold, and converted into a gray powder; in which form it easily mixes with Salts, and other matters. It also teaches the making Flowers of *Jupiter*; (which are *Tinn* Volatilized, and raised in form of Meal, by means of a Volatile Salt of *Salt-Peter*;) and the making an Oyl of *Mercury*, by dissolving sublimate Corrosive in Spirit of Wine; which may be done, altho' that Spirit is not able to dissolve Quick-Silver, nor *Mercurius Dulcis*.

A Cautic Oyl of *Antimony* is taught to be made by dissolving *Antimony* in the Acid Spirits of Salt and *Vitriol*.

A Method is given for drawing an Oyl and Spirit of *Paper*.

An Account of the *Peruvian Bark* is inserted, together with the manner of drawing a *Tincture*, and making an Extract, of it.

An Account is given of *Sugar*, and the Spirit of it, and of the *Phosphorus*,

Collegii Experimentalis, sive Curiosæ, pars Secunda;
per Jo. Christ Sturmium. Altorfi, 4°. 1685.

THE *Author* gives an account of the good success he had in using a *Glass Diving Bell*, made in a like form with that of *Wood*, mention'd by Monsieur *Pantbot* in the *Journal des Scavans*.

He treats of some amendments in the *Air-Pump*; particularly of that kind which is portable.

He relates some experiments tried on the *Baroscope*,
Polish't,

Polish'd planes &c. Some *Hygrostatical* Experiments, together with the description of the Instruments by which they were performed.

He writes of long *Siphons*, and their use in conveying Water; of *Glass Bubbles*, and the reason of their flying all into little peices upon breaking; of *Water-Pots*, sort of *Lamps*; and of *Stentoreophonic* Tubes; the invention of which he justly ascribes to Sr. *Samuel Morland*, looking on that Instrument of which *Kircher* makes mention, to be of a different shape from these.

He speaks of a new sort of *Thermoscope*, of the *Magdeburg Hemispheres*, mentioned by *Guerick*, and the difficulty of separating one from the other, when the *Air* included in them is rarified.

He discourses of the force of breath blown into a Bladder, and raising a considerable weight annex: and of the explaining muscular motion from this principle, after Dr. *Croon's* manner, proposing that by these means a statue of a man may be made to move in imitation of Nature.

He examines the experiment of the *Hydria Helmontiana*, urged by Dr. *More* as an argument for his *Hylarchic* Principle.

He describes an *Aerometer*, consisting of an *Hygrometer*, *Thermometer*, and *Barometer*. Speaking of magnetical Experiments, he affirms, that he has a large Needle, exceeding a *Rhinland* foot, and seven inches, both ends of which apply to either Pole of the *Magnet*.

To this Treatise the *Author* subjoyns an Epistle to Dr. *More* of *Cambridg*, concerning his *Hylarchic* Principle; where he examines the D^s Demonstrations of that Principle; and answers the arguments against the Elasticity of the Air,

Ophthalmographia, five Oculi ejusque partium descriptio Anatomica: cui accessit Nova Visionis Theoria, Regiæ Societati Londin. proposita. per Gui. Briggs, M. D. Colleg. Med. Londin. Socium, & Nosocomii Regal. (quod D^{vo}. Thomæ dicatur) Medicum Ordinarium. Editio altera: 8^{vo}. 1685. prostant venales apud Sam. Smith, ad Insignia Principis in Cæmeterio D Pauli; Londin.

Officina Chymica Londinensis; five exacta notitia Medicamentorum Spagyricorum, quæ apud Aulam Societatis Pharmaceuticæ Londin. præparantur, & Venalia prostant. Consilio Pharmacopæorum, & Approbatione Collegii Medicorum Londinensium exhibitum. Opera & studio Nicolai Staphorst, oper. Chym. dict. Societatis. prostant venales apud Gui. Miller, ad Insigne Glandis Auræ in Cæmeterio D. Pauli, 1685. 12°.

Errata in the Transactions for *August*.

P Ag. 1107, lines 10, 11, 12, 13. Dele [viz. Convulsionis quantanam observantis periodum, & Convulsivi affectus ultimariam periodum à multis annis observantis.] [Pag. 1113, line 4. for [Convulsionis--Observantis] read [Convulsiones - Observantes.]

Errata.

IN the Transactions for *September* and *October*, in the pag. following 1169 for [1870] read [1170.]

Printed at the Theater at Oxford for Sam. Smith at the Prince's Arms in Paul's Church-yard London; and Hen. Clements Book-seller in Oxford.

FINIS.

PHILOSOPHICAL

TRANSACTIONS.

November 26th. 1685.

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H h h

An Histo-

*An Historical account of a strangely self-moving
Liquor. By the Honorable Robert Boyle, Fel-
low of the Royal Society.*

AN Ingenious Teacher of Mathematicks, having occasion to make a Composition for a new *Fire-Engine*, whereof he was to shew his *Majesty* a Triall, mingled divers Ingredients in an Earthen Pot, over kindled Coals; but could not, or did not, do it so warily, but that the matter took fire, and began to blaze furiously; which oblig'd him to stifle the flame as hastily as he could: and having removed the Vessel from the fire, and suffered it to grow cold; when afterwards he came to look upon it, to see if what remained might be of any use to him, he was surpriz'd to find it variously and briskly mov'd. Wherefore having set it aside, to be sure that it might be thoroughly cold, he after some hours visited it again, and found it move as before. And having cast store of seeds upon it, to see if the Liquor would move them also, the Bituminous part of it connected them into a kind of thick Scum, that covered most of the *Superficies*; but yet left some Intervalls, in which the Liquor appeared, and discovered that it continued its motions. Two days after, the *Engineer* discoursing with me of his Fire work, about which he had advis'd with me before; told me, among other things, of this odd accident. And when I had asked him, if the motion continued still, and had been answered affirmatively, tho' it was then a dark night and ill weather, my Diffidence or my Curiosity made me engage him to send for the Pot as it was; partly to be sure of the matter of Fact, and partly to try, if the knowledge I had of the Ingredients,

ents, which he had before told me, would afford any hint, of the cause of so odd an Effect; alike to which in kind, tho' not in degree, I had many years before devised, and successfully practised, the way of producing.

The Vessel being come, tho' the hasty transportation of it seem'd to have sufficiently disturbed it, there did appear manifest signs of such a motion, as the *Engineer* had ascribed to it; and therefore he being willing to leave it with me, I caus'd it to be set aside in a Laboratory, where some Furnaces kept the *Air* constantly warm, and did there and elsewhere, at distant times, look heedfully upon it, now and then displacing, or quite taking off, some of the thick Scum, that too much covered the surface of it; and by this means I had the opportunity to take notice of several *Phænomena*, whereof these are the chief,

First I observ'd, that the motion of this Liquor was not only brisk, but very various; so that having loosen'd some small portions of the Scum from the rest, one of them would be carry'd towards the Right hand for instance, and another towards the left, at the same time.— 2. Where the Liquor first came out from under the Scum, it seem'd to move the most briskly, flowing almost like a stream, whose motion upwards had been check'd, and as it were reverberated, by that incumbent obstacle.— 3. Several motions in this Liquor were the more easy to be observ'd; because tho' it were dark, yet it was not uniform, consisting in part of Oily and Bituminous Ingredients, which tho' they seem'd to have but one common *Superficies* with the rest of the Liquor, yet by their colours and power of vigorously reflecting the light, they were easily enough distinguishable from the rest. And I often observed, that some of these unctious portions of the matter, emerging to the surface of the Liquor, tho' perhaps

at first one of them would not appear bigger than a pins head ; yet in moving forwards it would at the same time diffuse it self circularly, and make as it were a great *Halo*, adorn'd with the colours of the *Rain-bow*, and so very vivid, as afforded a very pleasant, and at first surprizing, spectacle ; these Phantasms often nimbly succeeding one another, and lasting till they lost themselves against or under the thick Scum.—4. The motions of this odd Liquor were not only various, but frequently Vortical ; to be satisfyed of which I sometimes put short bits of straw, or Fragments of some such like stuff, upon the discovered part of the surface of the Liquor, by which they were carryed towards very distant, if not opposite, parts of the Vessel at the same time. But to make the Vortical motion more evident, I severall times detach'd considerably large pieces of the thick Scum, from the rest of the body : and had the pleasure to see them move both with a progressive motion in crooked lines, and with a motion about their own middle most parts. All this while the Liquor, whose parts were thus briskly mov'd, was actually cold, as to sense.—5. To observe what the presence, or absence, of the free *Air* would do to this Liquor ; I caus'd many spoonfulls of it, with some of the Scum, to be put into a *Cylindrical* Glass, which tho' large it self, had a Neck belonging to it, that was but about the bigness of ones Thumb, that it might be well stop't with a Cork. But having by this means kept the free *Air* from having a full and immediate contact with the whole surface of the mixture, as it had when that mixture lay in the wide-mouth'd Vessel ; I could not perceive the Liquor to move to and fro, no not tho' the Orifice of the Neck were left open : whereas having at the same time powr'd some of the Liquor into a very shallow and wide Mouth'd Vessel, call'd in the shops a clear cak'd Glass, it moved rather more
than

then less nimbly and variously then in the great Earthen Pot, (which yet was of the same shape,) and shewed us many of those Vivid and self dilating Circles, that have been mentioned in the third Number. And these, by the fineness of their colours, and the quickness wherewith they succeeded one another, afforded a delightful spectacle as long as I staid to observe the Liquor. 6. Tho' the motions of the hitherto mentioned Liquor did not seem to be always equally brisk, yet they appeared to continue manifest and various in some diversities of Weather, as to cold and heat; and when I lookt on it by Candle light, as well as by Day light. And when being not well enough to visit it my self, I sent one purposely to look upon it, about ten a Clock at night, he brought me word that it continued to move as formerly, and so it has done for ten days. And how much longer it will continue to do so; Time must determine,

Postscript.

Some time after the foregoing Account had been written, when I came to look upon the Liquor (which in the mean time had been severall times viewed, and appeared to retain its motions) I found to my trouble, that some body's impertinent curiosity and heedlessness had crackt the lower part of the Earthen Pot; at which overture the Liquor, tho' not the Scum, was run out: which had put a period to our Observations, but that, foreseeing that such an Accident might happen, I had long before taken out some spoonfulls of the Liquor, and kept it close stopt in a Vial. By this means I had the opportunity to observe, that when I pour'd out the Liquor into a wide mouthd Vessel it would move as before, tho' this were done some weeks after it had been put up. And I remember that long after, having one day received the Honor of a Visit from a forreign Minister, who was an Inquisitive person and

Man of Letters, we chanced among other things, to talk of this Liquor. And tho' it were scarce to be hop'd, that it could still retain any of its motive Vertue, yet, to gratify his Curiosity, and that of some ingenious men there present, I caus'd the Vial to be brought, and having unstopt it, I pour'd out the Liquor into a conveniently shaped Vessel; in which after we had suffer'd it to rest a while, they were delightfully surprized to see it move (tho' not in my opinion quite so briskly as before, yet) very manifestly and variously. This encouraged me to think it possible, that it might retain some motion, tho' but languid, 7 or 8 weeks after; and therefore on the 25th. of *July* I look'd upon it again; and having caus'd it to be pour'd into a *China* Cup, it manifested at first a brisk and various motion. But this after a while did so slacken, that I began to have some suspicion, that the motion it was put into by Effusion, and the first contact of the *Air*, might have given it the greatest part of its agitation. But this being but suspicion, I put the Vessel into divers postures in a Window, the better to discover the true cause of this *Phænomenon*: but whilst I was busy about this, which ingross'd my attention; a mischance overturned the Cup, and, by throwing down the Liquor, put an end to my speculation. Yet this mischance hindred me but from observing, how long the odd agitation of our Liquor would have continued, but not from finding that it lasted a great while. For I shew'd it the *Forreign Minister* about or after the beginning of *June*, that is, about five months, or more, after the Liquor was first observed to move.

A Letter from the Reverend Dr Wallis, Profeffor of Geometry in the Univerfity of Oxford, and Fellow of the Royal Society, London, to Mr. Richard Norris, Concerning the Collection of Secants; and the true Divifion of the Meridians in the Sea-Chart.

AN old enquiry, (about the fum or Aggregate of *Secants*;) having been of late moved a-new; I have thought fit to trace it from its Original: with fuch folution as feems proper to it: Beginning firft with the general Preparation; and then applying it to the Particular Cafe.

General Preparation.

1. Becaufe Curve lines are not fo eafily managed as Streight lines: the Ancients, when they were to confider of Figures terminated (at left on one fide) by a Curve line (Convex or Concave,) as *AFKE*, Fig. 1. 2. did oft make ufe of fome fuch expedient as this following, (but diversly varied as occafion required.) Namely,

2. By Parallel Streight lines, as *AF*, *BG*, *CH*, &c, (at equal or unequal diftances as there was occafion,) they parted it into fo many fegments as they thought fit; (or fupposed it to be fo parted.)

3. Thefe fegments were *fo many wanting one*, as was the number of thofe Parallels.

4. To each of thefe Parallels, wanting one; they fitted Parallelograms, of fuch breadths as were the Intervalls (equal or unequal) between each of them (refpectively) and the next following. Which formed an Adfcribed Figure made up of thofe Parallelograms.

5. And, if they began with the Greatest (and therefore neglected the left,) such Figure was Circumscribed (as Fig. 1.) and therefore Bigger than the Curvilinear proposed.

6. If with the Left (neglecting the greatest;) the Figure was Inscribed (as Fig. 2.) and therefore Less than that proposed.

7. But, as the number of Segments was increased, (and thereby their breadths diminished;) the difference of the Circumscribed from the Inscribed (and therefore of either from that proposed) did continually decrease, so as at last to be less than any assigned.

8. On which they grounded their Method of exhaustion.

9. In cases wherein the Breadth of the Parallelograms, or Intervalls of the Parallels, is not to be considered, but their length only; (or, which is much the same, where the Intervalls are all the same, and each repeated $= 1$;) *Archimedes* (instead of Inscribed and Circumscribed Figures) used to say, *All except the Greatest*, and *All except the Left*. As Prop. 11. Lin. Spiral.

Particular Case.

10. Though it be well known, that, in the Terrestrial Globe, all the Meridians meet at the Pole, (as *EP*, *EP*, Fig. 3.) whereby the Parallels to the Equator, as they be nearer to the Pole, do continually decrease:

11. And hereby a degree of Longitude in such Parallels, is less than a degree of Longitude in the Equator, or a degree of Latitude:

12. And that, in such proportion, as is the Co-Sine of Latitude (which is the semidiameter of such Parallel) to the Radius of the Globe, or of the Equator:

13. Yet hath it been thought fit (for some reasons) to represent these Meridians, in the Sea Chart, by Parallel straight lines; as *EP*, *EP*.

14. Where-

14. Whereby, each Parallel to the Equator (as LA) was represented in the Sea-Chart, (as la ,) as equal to the Equator EE : and a degree of Longitude therein, as large as in the Equator.

15. By this means, each degree of Longitude in such Parallels, was increased, beyond its just proportion, at such rate as the Equator (or its Radius) is greater than such Parallel, (or the Radius thereof.)

16. But, in the Old Sea-Charts, the degrees of Latitude were yet represented (as they are in themselves) equal to each other; and, to those of the Equator.

17. Hereby, amongst many other Inconveniences, (as Mr. *Edward Wright* observes, in his *Correction of Errors in Navigation*, first published in the year 1599,) the representation of places remote from the Equator, was so distorted in those Charts, as that (for instance) an *Island* in the Latitude of 60 degrees, (where the Radius of the Parallel is but half so great as that of the Equator,) would have its Length (from East to West) in comparison of its Breadth (from North to South) represented in a double proportion of what indeed it is.

18. For rectifying this in some measure (and of some other inconveniences,) Mr. *Wright* adviseth; that (the Meridians remaining Parallel, as before) the degrees of Latitude, remote from the Equator, should at each Parallel, be protracted in like proportion with those of Longitude.

19. That is; As the Co-Sine of Latitude (which is the Semidiameter of the Parallel) to the Radius of the Globe, (which is that of the Equator:) so should be a degree of Latitude (which is every where equal to a degree of Longitude in the Equator,) to such degree of Latitude so protracted (at such distance from the Equator;) and so to be represented in the Chart.

20. That is; every where, in such proportion as is

the respective Secant (for such Latitude) to the Radius. For, As the Co-Sine, to the Radius; so is the Radius, to the Secant (of the same Arch or Angle;) as Fig. 4.
 $\Sigma. R :: R. f.$

21. So that (by this means) the position of each Parallel in the Chart, should be at such distance from the Equator, compared with so many *Equinoctial* Degrees or Minutes, (as are those of Latitude,) as are all the Secants (taken at equal distances in the Arch) to so many times the Radius.

22. Which is equivalent (as Mr. *Wright* there notes) to a Projection of the *Spherical* surface (supposing the Ey at the Center) on the concave surface of a Cylinder erected at right Angles to the Plain of the Equator.

23. And the division of Meridians, represented by the surface of a Cylinder erected (on the Arch of Latitude) at right Angles to the Plain of the Meridian (or a portion thereof.) The Altitude of such Projection (or portion of such Cylindrick surface) being, (at each point of such Circular base) equal to the Secant (of Latitude) answering to such point. As Fig. 5.

24. This Projection (or portion of the Cylindrick surface) if expanded into a Plain, will be the same with a Plain Figure, who's base is equal to a Quadrantal Arch extended (or a portion thereof) on which (as ordinates) are erected Perpendiculars equal to the Secants, answering to the respective points of the Arch so extended: The left of which (answering to the *Equinoctial*) is equal to the Radius; and the rest continually increasing, till (at the Pole) it be Infinite. As at Fig. 6.

25. So that, as ER/L . (a Figure of Secants erected at right Angles on EL , the Arch of Latitude extended,) to $ERRL$, (a rectangle on the same base, who's altitude ER is equal to the Radius;) so is EL (an Arch of the Equator equal to that of Latitude,) to the di-

distance of such Parallel, (in the Chart) from the Equator.

26. For finding this distance, answering to each degree and Minute of Latitude; Mr. *Wright* (as the most obvious way) Adds all the Secants (as they are found calculated in the Trigonometrical Canon) from the beginning, to the degree or Minute of Latitude proposed.

27. The sum of all which except the Greatest, (answering to the Figure Inscribed) is too Little: The sum of all except the Least, (answering to the Circumscribed,) is too Great, (which is that he follows:) And it would be nearer to the truth than either, if (omitting all these) we take the intermediates; for Min. $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, &c. or (the doubles of these) Min. 1, 3, 5, 7, &c. Which yet (because on the Convex side of the Curve) would be somewhat too Little.

28. But any of these ways are exact enough for the use intended, as creating no sensible difference in the Chart.

29. If we would be more exact; Mr. *Oughtred* directs (and so had Mr. *Wright* done before him) to divide the Arch into parts yet smaller than Minutes, and calculate Secants suting thereunto.

30. Since the Arithmetick of Infinites introduced, and (in pursuance thereof) the doctrine of Infinite series (for such cases as would not, without them, come to a determinate proportion;) Methods have been found for squaring some such Figures; and (particularly) the Exterior Hyperbola (in a way of continual approach) by the help of an Infinite series. As, in the *Philosophical Transactions*, Numb. 38, (for the Month of August 1668,) And my Book *Demotu*, Cap 5. prop. 31.

31. In Imitation whereof, it hath been desired (I find) by some, that a like Quadrature for this Figure of Secants (by an Infinite series fitted thereunto) might be found.

32. In

32. In order to which ; Put we, for the Radius of a Circle, R ; the right Sine of an Arch or Angle, S ; the Versed Sine, V ; the Co-Sine (or Sine of the Complement) $\Sigma = R - V = \sqrt{R^2 - S^2}$; the Secant, f ; the Tangent, T . Fig. 4.

33. Then is, $\Sigma . R :: R . f$. That is, $\Sigma) R^2 (S = \frac{R^2}{\Sigma}$; the Secant.

34. And $\Sigma . S :: R . T$. That is, $\Sigma) SR (T = \frac{SR}{\Sigma}$; the Tangent.

35. Now, if we suppose the Radius CP , Fig. 7. divided into equal parts, (and each of them $= \frac{1}{n} R$;) and, on these, to be erected the Co-Sines of Latitude LA :

36. Then are the Sines of Latitude in *Arithmetick* Progreſſion.

37. And the Secants answering thereunto, $Lf = \frac{R^2}{\Sigma}$.

38. But these Secants, (answering to right Sines in *Arithmetical* progreſſion,) are not those that stand at equal distances on the Quadrantal Arch extended, Fig. 6.

39. But, standing at unequal distances (on the same extended Arch ;) Namely, on those points thereof, who's right Sines (whilst it was a Curve) are in *Arithmetical* Progreſſion. As Fig. 8.

40. To find therefore the magnitude of $RELf$, Fig. 6. Which is the same with that of Fig. 8. (supposing EL of the same length in both ; however the number of Secants therein may be unequal :) we are to consider the Secants, though at unequal distances, Fig. 8. to be the same with those at equal distances in Fig. 7. answering to Sines in *Arithmetical* Progreſſion.

41. Now these Intervalls (or portions of the base) in Fig. 8. are the same with the intercepted Arches (or portions of the Arch) in Fig. 7. For this Base is but that Arch extended.

42. And these Arches (in parts infinitely small) are to be reputed equivalent to the portions of their respective Tangents intercepted between the same ordinates. As in Fig. 7. 9.

43. That

43. That is, Equivalent to the portions of the Tangents of Latitude.

44. And these portions of Tangents are, to the Equal intervalls in the base, as the Tangent (of Latitude) to its Sine.

45. To find therefore the true Magnitude of the Parallelograms (or segments of the Figure;) we must either protract the equal segments of the base Fig. 7. (in such proportion as is the respective Tangent to the Sine) to make them equal to those of Fig. 8.

46. Or else (which is equivalent) retaining the equal intervalls of Fig. 7. protract the Secants in the same proportion. (For, either way, the Intercepted Rectangles or Parallelograms will be equally increased) As LM . Fig. 9.

47. Namely; As the Sine (of Latitude) to its Tangent; so is the Secant, to a Fourth; which is to stand (on the Radius equally divided) instead of that Secant.

$$S. \frac{SR}{\Sigma} (\because \Sigma. R) \because \frac{R_2}{\Sigma} \cdot \frac{R_3}{\Sigma_2 = R_2 - S_2} = LM, \text{ Fig. 9.}$$

48. Which therefore are as the Ordinates in (what I call *Arith. Infin. Prop. 104.*) *Reciproca Secundanorum*: supposing Σ^2 to be squares in the order of Secundanes.

$$R^2 - S^2, R^3 \left(R, + \frac{S_2}{R}, + \frac{S_4}{R_3}, + \right.$$

49. This (because of $\Sigma^2 = R^2 - S^2$; and the Sines S , in Arithmetical Progreſſion) is reduced (by division) into this Infinite Series

$$R + \frac{S_2}{R} + \frac{S_4}{R_3} + \frac{S_6}{R_5}, \&c.$$

50. That is, (putting $R = 1$.)

$$1 + S^2 + S^4 + S^6, \&c.$$

51. Then (according to the *Arithmetick* of Infinites)

K k k

we

$$\begin{array}{r} \frac{R_3 - S_2 R}{+ S^2 R - \frac{S_4}{R}} \\ \hline + \frac{S_4}{R} \\ + \frac{S_4}{R} = \frac{S_6}{R_3} \\ \hline + \frac{S_6}{R_3} \end{array}$$

we are to interpret S, successively, by 1 S, 2 S, 3 S, &c. till we come to S, the greatest. Which therefore represents the number of All.

52. And because the first member doth represent a Series of Equals; the second, of Secundans; the third, of Quartans, &c. Therefore the first member is to be multiplied, by S; the second, by $\frac{1}{2}S$; the third, by $\frac{1}{3}S$; the fourth, by $\frac{1}{4}S$; &c.

53. Which makes the Aggregate,

$$S + \frac{1}{2}S^2 + \frac{1}{3}S^3 + \frac{1}{4}S^4 + \frac{1}{5}S^5, \text{ \&c.} = \text{E C L M, Fig. 9.}$$

54. This (because S is always less than R = 1) may be so far continued, till some power of S become so small as that it (and all which follow it) may be safely neglected.

55. Now (to fit this to the Sea-Chart, according to Mr. Wrights design:) Having the proposed Parallel (of Latitude) given; we are to find (by the Trigonometrical Canon) the Sine of such Latitude; and take, equal to it, CL = S. And, by this, find the magnitude of E C L M, Fig. 9; that is, of R E L f, Fig. 8. that is, of R E L f, Fig. 6. And then, As R R L E (or so many times the Radius,) to R E L f (the Aggregate of all the Secants;) so must be a like Arch of the Equator (equal to the Latitude proposed,) to the distance of such Parallel, (representing the Latitude in the Chart) from the Equator. Which is the thing required.

56. The same may be obtained, in like manner, by taking the Versed Sines in *Arithmetical* progression. For if the right Sines (as here) beginning at the Equator, be in *Arithmetical* progression, as 1, 2, 3, &c. Then will the Versed Sines, beginning at the Pole, (as being their complements to the Radius) be so also.

The Collection of Tangents.

57. The same may be applyed in like manner, (though that be not the present business,) to the Aggregate of Tangents, (answering to the Arch divided into equal parts.)

58. For,

58. For, those answering to the Radius so divided, are $\frac{SR}{\Sigma}$; (taking S in *Arithmetical* progression.)

59. And then, enlarging the Base (as in Fig. 8.) or the Tangent (as in Fig. 9.) in the proportion of the Tangent to the Sine.

$$S \cdot \frac{SR}{\Sigma} (\therefore \Sigma \cdot R) \therefore \frac{SR}{\Sigma} \cdot \frac{SR_2}{\Sigma_2} = \frac{SR_2}{R_2 - S_2}.$$

60. We have (by division) this Series,

$$S + \frac{S_3}{R_2} + \frac{S_5}{R_4} + \frac{S_7}{R_6} + \frac{S_9}{R_8} \&c. \quad R^2 S^2 \cdot SR^2 (S, + \frac{S_3}{R_2}, + \frac{S_5}{R_4}, +$$

$$61. \text{ That is (putting } R=1) \quad \frac{SR_2 - S_3}{S_3} + S^3 - \frac{S_5}{R_2}$$

$$S + S^3 + S^5 + S^7 + S^9, \&c. \quad \frac{S_5}{R_2} + \frac{S_7}{R_4} - \frac{S_9}{R_6}$$

62. Which (multiplying the respective members by $\frac{1}{2}S, \frac{1}{4}S, \frac{1}{6}S, \frac{1}{8}S, \frac{1}{10}S, \&c$) becomes

$$\frac{1}{2}S^2 + \frac{1}{4}S^4 + \frac{1}{6}S^6 + \frac{1}{8}S^8 + \frac{1}{10}S^{10}, \&c. \quad + \frac{S_7}{R_4}$$

Which is the Aggregate of Tangents to the Arch who's right Sine is S.

63. And this method may be a pattern for the like process in other cases of like nature.

An Explanation of the Figures of Several Antiquities, communicated by a Member of the Royal Society.

FIG. 10, 11, 12, 13, 14, 15. *Res Turpiculae*, or *Prinapi*, worn by Roman Children against Fascination.

16. An Ægyptian brass *Serapis*, or *Teraphim*.

17. A brass *Stilus Scriptorius*.

K k k 2 18, 19. Old

18, 19. Old Roman Keys of brass; one being a Ring to wear on a Womans finger.

20. An Iron Die, or *Alea*.

21. A flat Iron Die, or *Talus*; upon the narrow sides are 6. 5. 2. and 1.

22. A Roman Iron Ring.

23. An old Roman brass Ring, marked XXXV, for a slave to wear.

24. A brass Roman Ear-Ring.

25. A brass *Lunula*, or *Meniscus*.

26. A brass *Fibula*.

27, 28, 29, 30, 31. Antient *Pasts*, or *Opaque-Enamels* of divers colours, for Pavements; taken up at *Baia*.

The Figures 32, 33, 34. represent the *Cochineel Fly*, as seen on its belly by the help of the *Microscope*, and by the naked Ey, and as seen on its back thro' a *Microscope*; the Draughts of which were communicated by Dr *Tyson*, Fellow of the *Royal Society*.

A Letter from Mr. S^r Georg Ash, Sec. of the Dublin Society, to one of the Secretaries of the Royal Society; concerning a Girl in Ireland, who has several Horns growing on her Body.

Trin. Coll. the 10th of *Octo.* 1685.

Hon. Sir.

THE Account I here send of the *Horny Girl* is, much more imperfect then I hoped it would have been, both because its parents or friends, who might give some information of the beginning and occasion of the growing out of these *Horns*, are not to be found, and that the owner of this Monster would not be persuaded to let us take the figure thereof, which we design'd to present you.

She

She is called *Ann Jackson*, born in the *City of Waterford* of *English* parents, who are both said to have been sound and healthy; this infirmity did not shew it self, till she was about 3 years old, after which the Mother concealed her out of shame and brought her up privately; but she soon dying, and the father becoming exceeding poor, the Child was left as a charge upon the Parish. She is now between 13 and 14 years of Age, yet can scarce go, and is so little in stature, that I have seen Children of 5 years old taller; she is very silly, speaks but little, and that not plainly, hastily, and with difficulty, her voice is low and rough; her complexion and face well enough, except her Eyes, which look very dead, and seem to have a film or horn growing over 'em, so that she can hardly now perceive the difference of colours.

The *Horns* abound chiefly about the joynts and flexures, and not on the brawny fleshy parts of her body, they are fastned to the Skin like warts, and about the roots resemble them much in substance, tho' toward the extremitys they grow much harder and more *Horny*; at the end of each Finger and Toe, grows one as long as the Finger or Toe, not strait forwards, but rising a little between the nail and the flesh (for near the roots of these excrescencies is something like a nail) and bending again like a Turkey's claw, which too it much resembles in colour; on the other joynts of her Fingers and Toes are smaller ones, which sometimes fall off, others growing in their places. The whole Skin of her Feet, Legs, and Arms is very hard and callous, and does dayly grow more and more so; on her Knees and Elbows, and round about the joynts are many *Horns*; two more remarkable at the point of each Elbow, which twist like *Rams Horns*, that on the left Arm is above $\frac{1}{2}$ Inch broad, and 4 Inches long; on her buttocks grow a great number, which are flat by frequent sitting; at

her Armpits and the Nipples of her breasts, small hard substances shoot out, much slenderer and whiter then the rest; at each Ear also grows a *Horn*; The Skin of her neck does of late begin to turn callous and *Horny*, like that of her Hands and Feet. She eats and drinks heartily, sleeps soundly, and performs all the offices of nature like other healthy people, except that she never had the Evacuation proper to her Sex. This, *Sir*, is as particular an account as I can gather;

I am,

(Hon^d. *Sir*,) *Your very*

Humble Servant

S^r GEORGE ASHE.

Historia Ulceris in Inguine dextro, Intestinorum faeces emittentis; à D^{no}. Gui: Earnshaw, Medico Alcestrehsi, descripta & communicata.

Mulier quædam *Alcestrehsi* in agro *Warwicensi*, annos quasi quadraginta nata, à vicino oppido domum rediens, subito corripitur dolore vehementi inguinis dextri, cui successit singultus violentus: post semihoram tumor ibidem oritur ad quantitatem nucis moschatae, qui sensim fit durus, & tandem niger. Mulier febre, & aliis Doloribus adeo vexatur (nullo in auxilium Medico vocato) ut sui impos neminem astantium cognovit; ita ut precibus publicis Deo commendatur, tanquam jam moritura: tandem applicatione nescio cujus Cataplasmatidis, aperitur Bubo; à quo aperto quicquid bibit editve, immutatum plerumque intra horæ quadrantem vel dimidium, exit, sine vel minimo seu in ulcere, seu in Intestinis, dolore; ita ut cum die quodam

dam lac coctum comedisset, ex ulcere primo lac ipsum, postea coagulatum, cum crepitu (tanquam ab ano) & spuma erupit: imo cum pulli partem cum petroselinino comederat, utrumque per ulcus deposuit. Tandem ego vocatus (pro more talium animantium, ut scilicet animam jamjam egressuram paululum retardarem) invenio fæminam Hæcticam, emaciatam, sitibundam, urinam tamen sedesque, sine ullo dolore statis temporibus deponentem; ulcus 3 vel 4 digitos longum, latum vero unum, minime profundum, sed cum cute pene æquale. Ptisanam laxantem mitto pro 4 dosibus; sed cum Dosis prima statim per ulcus effluxit, nulla sede per diem sequuta, Bolum dedi purgantem; post semihoram etiam istius partem emittit. Postea tamen sedes duas cum multo minore, quam ante, ab ulcere effluxu; eundem Bolum die sequenti cepit; unde sedes tres, easque amplas habuit, cum scybalis multis; ulcus vero parum emittit, totam per noctem. Exinde potus exiccantis, & traumatici libras duas vel tres quotidie bibendas, interdum bolum etiam repetendum suadeo; horum usu per dies 14 (ut memini) sana evasit, & adhuc sana vivit.

*Part of a Letter containing a farther Account of the
Aqueduct near Versailles, &c.*

They are every where at work about *Versailles*, in making *Magazines* for the waters which are to come thither; as one upon the Mountain of *Montboreon* already cut, which will have 2200 Perches of surface (each perch being 18 French foot) and 12 foot in depth. In another place much lower, will be another *Magazine*, to receive the waters of many Pools, the most part of which as yet have no water in them. In the *Valley* of *Buc* will be an *Aqueduct*, the middle whereof will be raised 22 Fathom high, for conveying the Pools of *Sarle*, which its said contain much water, tho' there be nothing but rain to fill them. This *Aqueduct* is 300 fathom long, and passes through two *Mountains* which have been cut thro' upon that account. The *Valley* also on both sides of the *Aqueduct*, is raised 11 Fathom high to make passages.

An *Aqueduct* also is making neer the *Tower of Stone*, (where the Mills raise the water) which now will pass without force to the top of the *Mountain*, and there be part of it distributed into severall very great *Cisterns*, which are making above *Marli* for that place.

In fine, tis a surprizing thing, to see, in how many places they are here at work.

The Elevation of the *Aqueduct* of *Mantenon* is now set forth at but 2560 Fathom; whereas it was desired to be carryed on more then 8000 Fathom, and the remainder will be made of Earth, which must be brought thither: This Opinion prevails, in regard it gives a quicker dispatch, tho' it may be doubted it will not be for the better.

These 2560 Fathoms contain 242 *Arcades*, whose Aperture is 6 Fathom and $\frac{1}{2}$, and the face of each Pillar

lar, sustaining the Arches 4 fathom; there will be then on the side of *Mantenon* 33 single Arches, afterwards 71 double ones; (as having one Arch upon another) then 46 treble ones, which will generally be 216 foot 6 Inches high, (*viz.* up to the floor of the Channel) afterwards 72 double ones; then 20 single, which will reach to the Mound of Earth, that is to be 50 foot high.

From the ground up to the second *Arcade* are 16 fathom, from the *second* to the *third*, or upper *Arcade*, are 14 fathom, (which *Arcades* are double in number to those they stand upon,) and 6 fathom 6 Inches more, to the floor of the Channel, which will at least be 6 foot high, besides the Parapet.

The Pillars by the ground are 8 fathom thick, but what with the Slopes, and shortnings, which are made in every story; the Top where the Channel goes, will be but 20 foot broad: there will likewise be at each Pillar, a Buttreffs jetting out one fathom, and 2 fathom wide.

Tho' the foregoing Observations were made by a very Intelligent person, well skilled in things of this Nature, as being no stranger either to the writings of the Antients, or the Famous Ruins and Remainers of their Fabricks in *Italy*, and other places: yet he professes himself surprized with the greatness of this undertaking at *Verfaille*, and *Mantenon*; for the Magnificence of the design, the number of Labourers, the excessiveness of the Expence, and the admirable beauty of the Work.

Frederici Hoffmanni Fred. *Fil. M. D. Exercitatio
Medico Chymica de Cinnabari Antimonii.*

Lugd. Batavorum 1685 8^{vo}

THE Author of this Treatise designing to give an exact process of the *Cinnabar* of *Antimony*, and examine its Constituent principles; to Solve all Phænomena that occur in its preparation; to explain the Mode of its operation, and describe its Virtues: begins first with its two Ingredients *Antimony*, and *Sublimate*; and considers their principles in distinct Chapters; makes Experiment in what proportion *Salts*, and *Mercury* are Containd in *Sublimate*; gives you caution how to choose the *Sublimate*, and gives account what happened remarkable from distilling *Cinnabar* of *Antimony* with *Sublimate* adulterated with *Arsenick*.

Treating next of the Butter of *Antimony*, he examines its two Principles, the one *Saline* and fluid, the other *Firm* & dry, which he calls *Mercurius Vita*; & here again he makes tryall in what proportion each Ingredient is included in this Composition; he insists much upon the Management of the fire, and Vessels in this preparation; and shews a way how to prepare *Butter* of *Antimony* without fire.

And here he takes notice of that odd Phænomenon, why *Butter* of *Antimony* makes such an effervescence with *Spirit* of *Niter* only, and with no other Corrosive *Menstruum* besides; which he Solves by supposing that the *Spirit* of *Niter*, by its mixing with the *Salts* in the *Sublimate*, becomes an *Aqua Regis*, which works upon the Included *Antimonial* particles, just as that Corrosive *Menstruum* is observ'd to work upon the powder of *Antimony*.

Com-

Coming next to speak of *Cinnabar* of *Antimony*, he demonstrates these 3 Principles to exist in it, viz, *Mercury*, the *Sulphur* of *Antimony*, and an *Acid Spirit* impregnated with a *Vitriolick Sulphur*; that *Mercury* does chiefly constitute this Composition, he proves in that it comes very near in weight to common *Precipitate*. He likewise makes Experiments of the proportionable encrease of each Ingredient of *Cinnabar* by fire; particularly of the encrease of *Mercury*, which he proves both from the Observation of others and his own, in converting *Tinn*, *Lead* almost all into *Mercury*.

Mercury revived from *Cinnabar* of *Antimony* he prefers much before the common, either to *Amalgamate Metals*, or in *Medicine*: the cause of which he imputes, to the *Mercury's* being depurate from its *Metallick*, *terrene* and *heterogeneous* particles by the *Sulphur* of *Antimony*. To Revive *Mercury* from *Cinnabar*, he finds filings of *Steel*, or *Copper* to be more effectual then *Lixivial Salts*; to prove which, he mentions an Experiment (which he designs to make a nice tryal of again) where mixing 6 Ounces of *Mercury* with 10 ounces of *Salt* of *Tartar*, he obtained no more then 4 Ounces of *Mercury*.

Coming next to speak of the Preparation of *Cinnabar* of *Antimony*, according to others, and his own ways, he places much in subliming it often, and Cautions you as in poudering this, so to grind all other pouders exceeding fine; since grosser pouders serve only to absorb aciditys in the *Primæ Viæ*, and cannot enter the *Lacteals*, thence to be received by the mass of blood. He considers next how the Virtues of this *Cinnabar* may be exalted, whither by Solution, Fixation, or drawing a Tincture from it. Solution by Corrosive Menstruums, such as *Aqua Fortis*, *Aqua Regis*, *Spirit* of *Niter*, &c he condemns, as making it dangerous to be taken inwardly. Other Insipid Æthereal universal Solvents,

such as vain Chymists pretend to, he confesses himself ignorant of. Only this he has observed in his practice, that by pouring upon *Cinnabar*, sweet Spirit of *Vitriol*, though the Solution was only superficial; yet this Liquor did far exceed *Cinnabar* in Virtues.

Amongst the different ways of fixing *Cinnabar* by common Salt, Oyl of *Vitriol* or Sulphur, he gives a Method so to prepare *Cinnabar* with Spirit of Niter and Oil of *Vitriol*, that its Mercury will not tinge Gold white, and the *Cinnabar* thus prepar'd, thrown upon burning Coals, will all fly away. He supposes *Cnaffelius* preparation was such wherewith he cured the Gout; and the Author himself tells us that he has with this *Cinnabar*, extract of the *Cortex*, *Lesser Centory*, *Gentian*, and Salt of *Wormwood*, made up in *Bolus*, Cured some *Quartans* to admiration; yet he confesses 'tis not so fixt, but that its Mercury may easily be revived again. To draw a Tincture from *Cinnabar* he thinks not feasible, since he can find no Menstruum to dissolve it, but shews divers ways of drawing a Tincture from the Sulphur of *Antimony* included in the *Cinnabar*.

Lastly he observes that *Cinnabar* is the best corrector of *Opium*, and describes a Preparation of his, where *Opium* is so corrected, which he prefers before the richest *Laudanum*.

In explaining the manner of the operation of *Cinnabar*, he follows *Helmonts Philosophy*; and asserts, that it does not work only by absorbing Acid humors as some would have it; (since by the affusion of an Acid on *Cinnabar*, no alteration is produced) but by opening all obstructions, resolving Tartareous humors, promoting their excretion; invigorating the Spirits and the naturall ferments of the body; and destroying those that are noxious.

It may seem needless to mention all the diseases, against which he asserts *Cinnabar* to be effectual; since he explains its Operations to be much like those of a *Panacea*.

F I N I S.

PHILOSOPHICAL

TRANSACTIONS.

For the Month December, 1685.

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M m m

Some

Some remarkable effects of a great Storm of Thunder and Lightning at Portsmouth Oct. 23. 85.

I Cannot omit giving an Account of what hath hapned to us here the 23d. instant between 4 and 5 of the Clock in the Evening in the height of the Storm we had here.

On board his *Majestys* ship the *Royal James*, a flash of *Lightning* and *Thunder* together, took the Mast which was put into her for Careening, being a made Mast, and bound with Iron hoops from one end to the other, and shivered it down to the Deck, breaking one of the Iron hoops in the body of the Mast, so that Splinters are forc't out of the middle of the Mast a foot and $\frac{1}{2}$ long, (and a ball of fire run too and fro on the Deck) in so much that the Mast is wholly unserviceable and must be taken out.

On board the *Coronation*, notwithstanding the Ships head was to windward, a great Ball of fire came into the Gunroom Ports, and threw a Boy out of one of the Ports, and he was drowned ; and severall Workmen being on board, as Carpenters, Joyners, and Seamen, were struck down and made senseless for some time, and the Ball of Fire ran up and struck on the Starboard side of the Wardrobe, and left a place scorched round upon the side, and between the two Ring-bolts, as if it had been a shott ; and beat the Wainscott over to the other side, all scorcht as if with Fire ; and run up against the Doors and Hinges, away ; and run into severall Balls of Fire on the Deck amongst the Men ; and some part of it broke in at the Windows of the round house, and shivered off a great deal of the Wainscott, and broke the Glasses of a Perspective Glas, and made a hole through a Letter that lay in the Window eight double, the circumference of a Musket Bullet, and no more ; it also shivered the Timber that holds the Ensigne-staff on the Poop. *Portsmouth October 24th. 1685.* Seve-

Severall Observations of the Respect of the Needle to a piece of Iron held Perpendicular; made by a Master of a Ship Crossing the Æquinoctial Line, Anno 1684. and communicated by M^r. Arthur Bayly. F. of the R. S.

ALL the way from *England* to 10^{d} . *North Latitude*, the *North* point of the needle respected the upper end of the *Iron*, and the S° . point the lower end very strongly.

Latitude. 9^{d} . $42'$ N° . and *Meridian* distance from the *Lizard* 9^{d} . $32'$ *West*. The S° . point of the needle did strongly respect the lower end of the *Iron*, but the N° . point did not so strongly respect the upper end as before.

Lat^d. 4^{d} . $33'$ N° . and *Meridian* dist. 5^{d} . $18'$. *West* from the *Lizard*. In this *Lat^d*. the *North* point of the needle began to decline from the upper end of the *Iron*, and the S° . point to incline more strongly to the lower end.

Lat^d. 0^{d} . $52'$ S° . and *Meridian* dist. 11^{d} . $52'$ *West* from the *Lizard*. Here the *North* point of the needle would not respect the upper end of the *Iron*, nor the lower end neither, but the *South* point did still incline to the lower end, though not so strongly.

Lat^d. 5^{d} . $17'$ S° . and *Meridian* dist. 15^{d} . $09'$. *West* from the *Lizard*. Here the *South* point of the needle would turn to the lower end of the *Iron*, about 2 points, but remove the *Iron* any further, and it would fly away from it, and respect the *Poles* again; but it would not respect the upper end at all; neither would the *North* point respect either; but lay the *Iron* *Horizontall*, and let the ends of the *Iron* respect the *Poles* of the

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World,

World, and the *North* point of the needle would turn to the *South* end of the Iron, and contrarily the *South* point of the needle would turn to the *North* end of the Iron, and alter its respect to the *Poles* 5 or 6 points, and no farther; but hold the Iron perpendicular, and put the middle thereof to the needle, it would still respect the *Poles*.

Lat^d. 8^d. 17' *South*, and *Meridian* dist. from the *Lizard* 17^d. 35' *West*.

Here the N^o. point of the needle would not respect the upper end of the Iron, but rather forsake it, but the S^o. point would still something respect the lower end, and alter its true position about 2 points; but take the Iron and lay it aslope over the Compass, so that the upper end be towards the S^o. *Pole*, and the lower end to the N^o. and then the N^o. point would respect the lower end, and follow it; but if you point the upper end to the N^o. and the lower end to the S^o. the N^o. point will forsake it. But if you lay it *Horizontall*, it would do as in the foregoing Observations.

Lat^d. 15^d. 00' S^o. and 20^d. 00' *West* from the *Lizard*.

Here the S^o. point of the needle began to respect the upper end of the Iron, and the N^o. point the lower end, and follow'd it about one point; but lay the Iron *Horizontall*, and the N^o. point respected the S^o. end of the Iron, and contrarywise, &c.

Lat^d. 20^d. 20' S^o. and 19^d. 20' *West* from the *Lizard*.

Note that the S^o. point of the needle respected the upper end of the Iron, and the N^o. point the lower end pretty strongly, and follow'd it, 3 or 4 points; but lay it *Horizontall* and it would do as before.

Lat^d. 29^d. 25', and 13^d. 10' *West* from the *Merid.* of the *Lizard*..

Here the S^o. point of the needle respected the upper end of the Iron, and the N^o. point the lower end strongly.

An Abstract of a Letter from Mr. J. Flamsteed, Math. Reg. & F. of the R. S. giving an account of the Eclipses of $\mathbb{Z}^s$ Satellits, anno 1686; and containing a Table of the Parallaxes of $\mathbb{Z}^s$ Orb, and an Ephemeris of $\mathbb{Z}^s$ Geocentric Places for the same year.

Sir,

I Give you here the Eclipses of *Jupiters Satellits* for the next year 1686, deduced from the same numbers by which I calculated those of the years 1684, and 1685, printed in the *Transactions*. I shall not need to shew here again, how to find within what limits on our Earth any of them, not visible with us, will be observable; having done it already both in *English* and *Latin* in those Tracts; I shall therefore only tell you that all my observations of them since made, (which have not been many by reason of our much cloudy weather and my frequent avocations,) have fully made good my assertions concerning them, and that I have not found my numbers at any time since to err above one minute in the *Eclipses* of the first or innermost *Satellit*; so that if a way were found of managing a Tube of 8, 10, or 12 foot long at *Sea*, and Observing the time as exactly as we can at land, Observations of these *Eclipses* would certainly give us the difference of Longitude, as exactly as the Latitudes are pretended to be Observed by our more knowing *Sea-Men*, and certainly much better then the Observations of *Lunar Eclipses*. How the differences of Longitude are gained by them, you will see by the following Examples, the latter of which I have purposely produced to

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shew the good agreement of my numbers with the heavens.

Anno 1680, *October* 23, old *Stile*, Signior *Joseph Ponthia*, and *Marco Antonio Cellio* with a Telescope of 25 *Palms* long, Observed the totall Immersion of the first *Satellit* into Ψ^s shadow at Rome at $10^h. 07'. 53''$. p. m, which in our Observatory here I noted at $9. 15. 41$, whose difference is the difference of our Meridians = $52'-12''$, or $13^\circ. 0'3$.

Again, *January* the 28 1685, Signior *Francis Blanchini*, having received my Catalogue of the *Eclipses* of the *Satellites* for that year, observed the totall Immersion of the 1st at Rome, at $11^h. 19^{\frac{3}{4}}$ which I saw not here, but my numbers give at $10. 27^{\frac{1}{4}}$. Therefore the difference of Meridians is $0 \quad 52^{\frac{1}{2}}$; and Rome lies so much more Easterly then the Observatory at *Greenwich*, agreeing with the former observation, and shewing the error of the Tables to be insensible.

The noble *Tycho* judged therefore not much amiss, when he placed *Uraniburg* and Rome under the same Meridian; for by severall observations of *Satellit Eclipses*, it is evident, that the difference of Meridians betwixt *Uraniburg* and our Observatory is $51'. 10''$. of time, so that Rome lies only one minute of time or $\frac{1}{4}$ of a degree to the East of *Uraniburg*.

Some Ingenuous persons having often wished that such Tables of the *Satellites* motions were published, as might serve to find their appearances at any given time, tho I think it not fit (by reason they are capable of much Correction and great improvement) to publish mine at present: yet for the sake of the diligent observer, I have contrived a small Instrument, whereby with the sole help of the following Catalogue, and the Table of the *Parallaxes* of Ψ^s orb, their distances from the Axis of Ψ may be found to any given time within the compass of the next year, and for any future year by the like Tables.

To make the Catalogue of *Eclipses*, as also the Table of the *Parallaxes* of Ψ , it was necessary first to make a Table of Ψ^s *Heliocentrick* places, to which the *Parallaxes* being applied, give the *Geocentrick*. The vulgar Ephemerides are very faulty in this Planet, and no good one being extant this year, I here give you a copy of mine deduced from my own corrected Tables, which I am perswaded will be of good use and very acceptable to the Ingenuous Student of *Astronomy*.

[1218]

Tabula Parallaxium Orbitæ Jovialis Anno. 1686.

	<i>Janu.</i>	<i>Febr.</i>	<i>Martii</i>	<i>Apri.</i>	<i>Maii</i>	<i>Junii</i>
	Parallax. Adde.	Parall. Adde.	Parall. Adde.	Parall. Adde.	Parall. Sub	Parall. Sub.
D	0 1	0 1	0 1	0 1	0 1	0 1
1	9 22	10 32	9 18	5 11	0 41	6 29
2	9 26	10 31	9 13	5 00	0 53	6 39
3	9 31	10 31	9 07	4 49	1 05	6 48
4	9 35	10 30	9 01	4 39	1 18	6 58
5	9 39	10 30	8 55	4 28	1 30	7 06
6	9 42	10 29	8 49	4 17	1 42	7 15
7	9 46	19 28	8 43	4 06	1 54	7 24
8	9 50	10 27	8 37	3 55	2 06	7 32
9	9 53	10 26	8 30	3 44	2 18	7 41
10	9 56	10 24	8 24	3 32	2 30	7 49
11	9 59	10 22	8 17	3 21	2 42	7 57
12	10 02	10 20	8 09	3 09	2 54	8 05
13	10 05	10 18	8 02	2 57	3 06	8 12
14	10 08	10 15	7 54	2 45	3 17	8 20
15	10 10	10 13	7 47	2 33	3 29	8 27
16	10 13	10 10	7 39	2 22	3 40	8 34
17	10 15	10 07	7 31	2 10	3 52	8 41
18	10 17	10 04	7 23	1 58	4 03	8 48
19	10 19	10 01	7 14	1 46	4 14	8 55
20	10 21	9 57	7 06	1 34	4 25	9 01
21	10 23	9 54	6 57	1 22	4 36	9 07
22	10 25	9 50	6 48	1 09	4 47	9 13
23	10 26	9 46	6 39	0 57	4 58	9 19
24	10 27	9 42	6 29	0 45	5 09	9 25
25	10 29	9 37	6 20	0 32	5 19	9 31
26	10 30	9 33	6 11	0 21	5 30	9 36
27	10 31	9 28	6 01	0 09	5 40	9 41
28	10 32	9 23	5 51	Sub. 04	5 50	9 46
29	10 32		5 42	0 16	6 00	9 51
30	10 32		5 31	0 28	6 10	9 55
31	10 32		5 21		6 19	

Julii

	Julii	Augu.	Sept.	Octob.	Nov.	Decem.
	Parall. Sub.	Parall. Sub.	Parall. Sub.	Parall. Sub.	Parall. Sub.	Parall. Add.
D	0	0	0	0	0	0
1	10 00	10 51	9 17	6 10	2 00	2 21
2	10 04	10 49	9 12	6 03	1 51	2 30
3	10 08	10 48	9 07	5 55	1 43	2 38
4	10 12	10 47	9 02	5 48	1 34	2 47
5	10 16	10 46	8 57	5 41	1 25	2 55
6	10 19	10 44	8 52	5 33	1 17	3 04
7	10 23	10 42	8 46	5 25	1 08	3 12
8	10 26	10 41	8 40	5 17	0 59	3 21
9	10 29	10 39	8 35	5 09	0 51	3 29
10	10 32	10 36	8 29	5 02	0 42	3 38
11	10 34	10 34	8 23	4 53	0 33	3 46
12	10 37	10 32	8 17	4 46	0 24	3 54
13	10 39	10 29	8 12	4 38	0 16	4 02
14	10 41	10 26	8 06	4 29	0 07	4 10
15	10 43	10 24	7 59	4 21	Add: 2	4 18
16	10 45	10 21	7 53	4 13	0 11	4 26
17	10 46	10 18	7 47	4 06	0 20	4 35
18	10 48	10 15	7 40	3 57	0 28	4 43
19	10 49	10 11	7 34	3 49	0 37	4 51
20	10 50	10 08	7 27	3 41	0 46	4 59
21	10 51	10 04	7 21	3 32	0 55	5 07
22	10 51	10 00	7 14	3 24	1 03	5 15
23	10 52	9 56	7 07	3 16	1 12	5 22
24	10 52	9 53	7 00	3 08	1 21	5 30
25	10 53	9 49	6 53	2 59	1 29	5 38
26	10 53	9 45	6 46	2 51	1 38	5 46
27	10 53	9 40	6 39	2 43	1 47	5 52
28	10 53	9 36	6 32	2 34	1 55	6 00
29	10 53	6 31	6 25	2 25	2 04	6 08
30	10 52	9 27	6 18	2 17	2 13	6 15
31	10 51	9 22		2 08		6 23

Catalogus Eclipsium Comitum Jovialium ubique terrarum Anno 1686.
visibilibus, tempora apparentia Ingressuum illorum in Jovis Umbram &
ab ea Emerfionum, ad Meridianum Observatorii Grenovifani fupputata
exhibens, à Johanne, Flamsteedio Math. Reg. & R. S. S.

Januarii			Februarii			Martii		
d.	b.		d.	b.		d.	b.	
1	08 18	2 i	2	07 45	2 i	1	4 23	3 i
	11 27	1 i		7 49	1 i	2	15 26	1 * i
2	20 47	3 { e	4	02 18	1 i		18 07	2 * i
	23 23	3 { e	5	20 46	1 i	4	09 55	1 i
3	05 55	1 i		21 03	2 i	6	04 24	1 i
4	21 35	2 i	7	15 14	1 * i		7 25	2 i
5	00 22	1 i		16 27	3 * i	7	22 53	1 i
6	18 50	1 * i		19 04	3 * e	8	08 22	3 i
8	10 50	2 i	9	09 43	1 i	9	17 22	1 * i
	13 18	1 i		10 20	2 i		20 43	2 i
10	00 42	3 { e	11	04 11	1 i	11	11 50	1 * i
	3 18	3 { e	12	22 40	1 i	13	06 19	1 i
	7 45	1 i		23 38	2 i		9 52	2 i
12	0 07	2 i	14	17 08	1 * i	15	00 48	1 i
	2 13	1 i		20 24	3 { e		12 22	3 * i
13	20 41	1 i		23 01	3 { e	16	19 17	1 i
15	13 22	2 i	16	11 37	1 i		23 20	2 i
	15 09	1 * i		12 55	2 * i	18	13 46	1 * i
17	05 37	3 { e	18	06 06	1 i	20	08 15	1 i
	08 13	3 { e		20 00	1 i		12 38	2 * i
	09 37	1 i		2 13	2 i	22	02 44	1 i
19	02 39	2 i	21	19 03	1 i		16 22	3 * i
	4 04	1 i		22 00	3 i	23	21 13	1 i
20	22 32	1 i	22	03 01	3 e	24	01 54	2 i
22	15 55	2 * i	23	13 31	1 * i	25	15 50	1 * i
	17 00	1 * i		15 31	2 * i	27	10 10	1 * i
24	08 33	3 { e	25	8 00	1 i		15 15	2 * i
	11 09	3 { e	27	02 34	1 i	29	04 39	1 i
	11 28	1 i		4 49	2 i		20 21	3 i
26	05 12	2 i	28	20 57	1 i	30	23 08	1 i
	5 57	1 i				31	04 33	2 i
28	0 25	1 i						
29	18 29	2 * i						
	18 53	1 * i						
31	12 30	3 i						
	13 21	1 i						
	15 06	3 * e						

Apr.

<i>Aprilis</i>			<i>Maii</i>			<i>Iunii</i>		
<i>d.</i>	<i>h.</i>	'	<i>d.</i>	<i>h.</i>	'	<i>d.</i>	<i>h.</i>	'
1	17	37	1	21	59	1	00	03
3	12	05	2	06	54	2	10	49
	17	51	3	16	28		18	30
5	06	35	4	18	57	3	06	31
6	00	21	5	10	56	4	13	00
7	01	03		20	12	6	07	28
	7	09	7	05	25		19	48
8	19	32	8	23	53	8	01	55
10	14	01	9	09	30	9	14	47
	20	28	10	18	22		20	25
12	08	10	11	22	55	10	09	06
13	04	20	12	12	50	11	14	53
14	02	58		22	47	13	09	21
	9	46	14	07	19		22	23
15	21	27	16	01	47	15	03	49
17	15	57		12	06	16	18	45
	23	04	17	20	15		22	18
19	10	25	19	02	53	17	11	40
20	08	20	19	14	44	18	16	46
21	04	54	20	01	22	20	11	15
	12	22	21	09	12	21	00	58
22	23	22	23	03	41	22	05	43
24	17	51		14	39	23	22	43
25	01	40	24	22	09	24	00	12
26	12	19	20	06	51		14	15
27	12	18		16	37	25	18	40
♂ ☉ ♀	7		27	03	57	27	13	09
28	09	02	28	11	05	28	03	33
	17	37	30	05	34	29	07	37
30	03	31		16	14	30	23	58

Iulii

Julii			Augusti			Septemb.		
d.	b.		d.	b.		d.	b.	
1	02 06	1 e	1	22 44	1 e	1	01 02	1 e
	2 42	3 e	2	16 35	2 e	2	19 31	1 e
	16 50	2 e	3	17 14	1 e	3	12 02	3 { i
2	20 34	1 e	5	11 43	1 e		13 50	3 { e
4	15 03	1 e		19 57	3 { i		16 27	2 e
5	06 08	2 e		22 43	3 { e	4	14 00	1 e
6	09 31	1 * e	6	05 53	2 e	6	08 30	1 e
8	03 59	3 i	7	06 12	1 e	7	05 46	2 e
	3 59	1 e	9	00 41	1 e	8	02 59	1 e
	6 41	3 e		18 12	2 e	9	21 29	1 e
	19 26	2 e	10	19 10	1 i	10	16 04	3 { i
9	22 29	1 e	12	13 39	1 i		18 52	3 { e
11	16 57	1 e		23 58	3 { i		19 05	2 e
12	08 44	2 * e	13	02 44	3 { e	11	15 58	1 e
13	11 26	1 e		8 51	2 * e	13	10 27	1 e
15	05 55	1 e	14	8 09	1 * e	14	08 25	2 e
	7 57	3 * i	16	02 38	1 e	15	04 57	1 e
	10 40	3 * e		21 51	2 e	16	23 26	1 e
	22 02	2 e	17	21 07	1 e	17	21 44	2 e
17	00 24	1 e	19	15 36	1 e		22 54	3 e
18	18 53	1 e	20	03 59	3 { i	18	17 55	1 e
19	11 21	2 e		6 45	3 { e	20	12 25	1 e
20	13 21	1 e		11 10	2 e	21	11 03	2 e
22	07 51	1 * e	21	10 05	1 e	22	06 44	1 * e
	11 56	3 { i	23	04 35	1 e	24	01 23	1 e
	14 41	3 { e	24	00 29	2 e	25	00 23	2 e
23	00 39	2 e		23 04	1 e		2 56	3 e
24	02 19	1 e	26	17 33	1 e		19 52	1 e
25	20 49	1 e	27	08 01	3 * i	27	14 22	1 e
27	13 57	2 e		10 48	3 { e	28	13 42	2 e
	15 17	1 e		13 48	2 e	29	08 51	1 e
29	09 47	1 * e	28	12 03	1 e			
	15 56	3 { i	30	06 32	1 e			
	18 41	3 { e	31	03 08	2 e			
30	03 16	2 e						
31	04 15	1 e						

Octobris			Decemb.		
d.	b.		d.	b.	
1	02 20	1 e	1	10 12	2 i
2	03 01	2 e	23	38	1 i
	4 58	3 e	3	18 06	1 i
	21 49	1 e	4	23 28	2 i
4	16 18	1 e	5	12 33	1 i
5	16 19	2 e	15	45	3 i
6	10 47	1 e	7	07 00	1 i
8	05 16	1 * e	8	12 15	2 i
9	05 38	2 * e	9	01 29	1 i
	10 58	3 e	10	19 56	1 * i
	23 45	1 e	12	02 00	2 i
11	18 14	1 e		14 24	1 i
12	18 56	2 e		19 40	3 * i
13	12 43	1 e	14	08 51	1 i
15	07 12	1 e	15	15 15	2 i
16	8 15	2 e	16	03 18	1 i
	14 58	3 e	17	21 46	1 i
17	01 41	1 e	19	04 31	2 i
18	20 09	1 e		16 14	1 i
19	21 33	2 e		23 34	3 i
20	14 38	1 e	21	10 42	1 i
22	09 07	1 e	22	17 46	2 * i
23	10 51	2 e	23	05 09	1 i
	18 58	3 e	24	23 37	1 i
24	03 35	1 e	26	07 03	2 i
25	02 04	1 e		18 04	1 * i
27	00 08	2 e	27	02 29	3 i
	16 32	1 e	28	12 32	1 i
29	11 01	1 e	20	20 18	2 * i
30	13 26	2 e	30	07 00	1 i
	22 57	3 e			
31	05 29	1 * e			
Novembre toto ☿ latet sub Radiis solis					

Quartus hoc Anno
Umbram non in-
greditur, sed ☿ e sole
emergente, in penum-
bram solummodo in-
cidit. Interea pla-
num ad Axem Um-
brae & Jovis orbi-
tam perpendicularare
pertransit temporibus
infra notatis. 1686.

	d.	b.
Janua.	12	12 07
	29	6 0
Februa.	15	0 0
Martii	3	17 56
	20	11 * 57
Aprilis	6	5 59
	23	0 00
Maii	9	17 59
	26	11 * 57
Junii	12	5 54
	28	23 52
Julii	15	17 52
Augusti	1	11 55
	18	6 00
Septemb.	4	0 08
	20	18 15
Octob.	7	12 21
	24	6 23
Decemb.	13	12 8
	30	5 39
2 ^a post. in penumbra.		

Jovis Loca Geocentrica Anno 1686.

D	Janu.		Feb.		Martii.		April.		Maii.		Junii	
	°	m	°	m	°	m	°	m	°	m	°	m
1	18	12	21	45	22	40	20	56	17	23	13	59
2	18	21	21	49	22	39	20	50	17	16	13	54
3	18	30	21	53	22	38	20	44	17	08	13	49
4	18	38	21	57	22	37	20	38	17	1	13	45
5	18	47	22	01	22	36	20	32	16	53	13	41
6	18	55	22	04	22	34	20	25	16	48	13	37
7	19	03	22	08	22	33	20	19	16	38	13	33
8	19	12	22	12	22	31	20	12	16	31	13	29
9	19	20	22	15	22	29	20	06	16	24	13	25
10	19	27	22	18	22	27	19	59	16	16	13	22
11	19	35	22	21	22	25	19	52	16	9	13	18
12	19	43	22	24	22	22	19	45	16	2	13	15
13	19	50	22	26	22	19	19	38	15	54	13	12
14	19	51	22	28	22	17	19	31	15	47	13	9
15	20	05	22	30	22	13	19	24	15	40	13	7
16	20	12	22	32	22	10	19	16	15	34	13	4
17	20	19	22	34	22	06	19	9	15	27	13	2
18	20	25	22	35	22	03	19	2	15	20	13	0
19	20	32	22	37	21	59	18	55	15	14	12	58
20	20	38	22	38	21	55	18	47	15	07	12	56
21	20	45	22	39	21	51	18	40	15	1	12	54
22	20	51	22	40	21	47	18	32	14	55	12	53
23	20	57	22	40	21	43	18	25	14	48	12	52
24	21	03	22	41	21	38	18	17	14	42	12	51
25	21	09	22	41	21	33	18	9	14	36	12	50
26	21	15	22R	41	21	28	18	2	14	31	12	49
27	21	20	22	41	21	23	17	54	14	25	12	49
28	21	26	22	40	21	18	17	47	14	20	12	48
29	21	31			21	13	17	39	14	14	12	48
30	21	36			21	8	17	31	14	9	12D	48
31	21	40			21	2			14	4		

D	Julii		Aug.		Septem.		Octob.		Novem.		Decem.	
	°	m	°	m	°	m	°	m	°	+	°	+
1	12	48	14	22	18	21	23	49	0	26	7	10
2	12	49	14	28	18	31	24	1	0	39	7	23
3	12	49	14	34	18	41	24	14	0	53	7	36
4	12	50	14	40	18	51	24	26	1	6	7	49
5	12	51	14	46	19	0	24	38	1	20	8	3
6	12	52	14	52	19	10	24	50	1	33	8	16
7	12	54	14	59	19	20	25	03	1	46	8	29
8	12	55	15	5	19	31	25	15	2	0	8	42
9	12	57	15	12	19	41	25	28	2	13	8	55
10	12	59	15	18	19	51	25	41	2	27	9	8
11	13	01	15	25	20	2	25	53	2	40	9	21
12	13	3	15	33	20	13	26	6	2	54	9	35
13	13	5	15	40	20	23	26	19	3	7	9	48
14	13	8	15	47	20	34	26	32	3	20	10	1
15	13	11	15	55	20	45	26	45	3	34	10	13
16	13	13	16	2	20	56	26	58	3	48	10	26
17	13	17	16	10	21	7	27	10	4	2	10	39
18	13	20	16	18	21	18	27	22	4	15	10	52
19	13	23	16	26	21	29	27	35	4	28	11	05
20	13	27	16	34	21	41	27	48	4	42	11	17
21	13	31	16	43	21	52	28	1	4	55	11	30
22	13	35	16	51	22	3	28	14	5	8	11	42
23	13	40	17	0	22	15	28	27	5	21	11	55
24	13	44	17	8	22	26	28	40	5	35	12	08
25	13	48	17	17	22	38	28	53	5	49	12	20
26	13	52	17	26	22	50	29	6	6	3	12	32
27	13	57	17	35	23	1	29	20	6	16	12	44
28	14	01	17	44	23	13	29	33	6	29	12	57
29	14	6	17	53	23	25	29	46	6	43	13	09
30	14	11	18	3	23	38	29	59	6	56	13	21
31	14	17	18	12			0	+	13		13	34

A Correct TIDE TABLE, shewing the true times of the *High-Waters* at *London-Bridge*, to every day in the year, 1686. By *J. Flamsteed* Math. Reg. & R. S. S.

Day	January				February				March			
	Morning		Afternoon		Morning		Afternoon		Morning		Afternoon	
	H	M	H	M	H	M	H	M	H	M	H	M
1	2	13	3	29	3	50	4	04	2	59	3	14
2	3	46	4	00	4	20	4	35	3	30	3	46
3	4	01	4	30	4	52	5	10	4	03	4	20
4	4	45	5	01	5	29	5	52	4	37	4	56
5	5	20	5	39	6	16	6	43	5	17	5	41
6	6	01	6	25	7	15	7	49	6	08	6	38
7	6	49	7	15	8	02	9	08	7	01	7	48
8	7	43	8	15	9	48	10	30	8	28	9	08
9	8	49	9	26	11	11	11	51	9	48	10	28
10	10	00	10	46			0	29	11	08	11	46
11	11	25			1	03	1	34		0	20	
12	0	04	0	41	2	00	2	25	0	50	1	17
13	1	15	1	48	2	45	3	04	1	42	2	05
14	2	19	2	44	3	02	3	37	2	02	2	44
15	3	04	3	25	3	52	4	07	3	01	3	16
16	3	43	4	00	4	23	4	39	3	31	3	46
17	4	01	4	34	4	55	5	12	4	02	4	18
18	4	50	5	08	5	31	5	53	4	34	4	51
19	5	26	5	46	6	15	6	39	5	09	5	30
20	6	07	6	29	7	06	7	34	5	53	6	17
21	6	52	7	18	8	05	8	36	6	04	7	12
22	7	44	8	13	9	11	9	44	7	42	8	13
23	8	42	9	11	10	18	10	52	8	46	9	19
24	9	04	10	17	11	25	11	57	9	51	10	23
25	10	50	11	24			0	27	10	55	11	26
26	11	57			0	54	1	19	11	57		
27	0	28	0	56	1	43	2	05	0	25	0	51
28	1	21	1	45	2	02	2	43	1	01	1	38
29	2	08	2	28					2	01	2	22
30	2	47	3	04					2	40	2	59
31	3	01	3	34					3	17	3	34

April

Day	April.				May.				June.			
	Morning.		Afternoon.		Morning.		Afternoon.		Morning.		Afternoon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	3	51	4	10	4	20	4	49	5	54	6	20
2	4	30	4	51	5	01	5	40	6	47	7	14
3	5	14	5	41	6	10	6	40	7	43	8	11
4	6	01	6	43	7	12	7	44	8	39	9	08
5	7	18	7	54	8	17	8	50	9	36	10	06
6	8	33	9	11	9	23	9	54	10	35	11	05
7	9	48	10	25	10	25	10	54	11	34		
8	10	58	11	30	11	23	11	51	0	01	0	29
9			0	00	0		0	17	0	56	1	21
10	0	29	0	55	0	43	1	08	1	46	2	09
11	1	01	1	41	1	32	1	54	2	30	2	50
12	2	03	2	22	2	15	2	34	3	07	3	24
13	2	40	2	57	2	53	3	10	3	04	3	56
14	3	14	3	30	3	27	3	44	4	12	4	28
15	3	46	4	00	4	00	4	17	4	45	5	01
16	4	16	4	33	4	34	4	52	5	19	5	38
17	4	51	5	11	5	12	5	32	5	59	6	20
18	5	03	5	57	5	54	6	16	6	42	7	06
19	6	22	6	48	6	40	7	06	7	32	7	59
20	7	16	7	45	7	32	7	59	8	02	8	59
21	8	13	8	46	8	28	8	56	9	32	10	06
22	9	16	9	45	9	26	9	56	10	42	11	18
23	10	15	10	46	10	26	10	57	11	54		
24	11	15	11	14	11	28	11	59	0	32	1	08
25	0		0	12			0	30	1	41	2	12
26	0	41	1	08	1	01	1	32	2	39	3	03
27	1	34	1	58	1	50	2	25	3	02	3	46
28	2	21	2	43	2	50	3	13	4	06	4	25
29	3	03	3	24	3	34	3	56	4	43	5	02
30	3	45	4	05	4	01	4	42	5	23	5	45
31					5	05	5	28				

Day.	July.				August				September			
	Morning.		Afternoon.		Morning.		Afternoon.		Morning.		Afternoon.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
1	6	08	6	32	7	00	7	34	8	46	9	19
2	6	57	7	22	8	10	8	35	9	53	10	26
3	7	49	8	17	9	08	9	42	10	59	11	35
4	8	04	9	16	10	16	10	49			0	00
5	9	47	10	18	11	21	11	53	0	02	0	55
6	10	49	11	20			0	23	1	19	1	41
7	11	51			0	52	1	19	2	02	2	21
8	0	21	0	50	1	04	2	06	2	39	2	55
9	1	16	1	41	2	25	2	43	3	10	3	25
10	2	04	2	25	3	00	3	15	3	41	3	56
11	2	04	3	03	3	30	3	44	4	12	4	29
12	3	19	3	34	3	58	4	12	4	04	5	07
13	3	50	4	04	4	27	4	42	5	30	5	56
14	4	19	4	34	4	59	5	18	6	25	6	58
15	4	49	5	05	5	03	6	02	7	32	8	11
16	5	23	5	42	6	28	6	57	8	51	9	32
17	6	04	6	27	7	31	8	07	10	12	10	52
18	6	05	7	19	8	46	9	27	11	30		
19	7	49	8	21	10	09	10	51	0	05	0	36
20	8	56	9	32	11	31			1	05	1	32
21	10	12	10	55	0	11	0	47	1	56	2	19
22	11	36			1	01	1	48	2	38	2	58
23	0	15	0	52	2	15	2	36	3	13	3	29
24	1	26	1	56	2	57	3	14	3	45	4	01
25	2	02	2	51	3	31	3	46	4	18	4	35
26	3	11	3	29	4	03	4	18	4	05	5	11
27	3	47	4	04	4	34	4	52	5	35	5	59
28	4	21	4	37	5	10	5	30	6	25	6	51
29	4	55	5	14	5	05	6	16	7	21	7	52
30	5	33	5	55	6	42	7	11	8	23	8	55
31	6	16	6	40	7	41	8	12				

Day	October		November		December	
	Morning. H. M.	Afternoon. H. M.	Morning H. M.	Afternoon. H. M.	Morning. H. M.	Afternoon. H. M.
1	9 26	9 56	10 38	11 07	10 28	10 59
2	10 27	10 58	11 36		11 29	
3	11 02	11 57	0 03	0 33	0 01	0 33
4		0 23	0 56	1 20	1 05	1 35
5	0 48	1 12	1 45	2 08	2 04	2 30
6	1 35	1 56	2 31	2 52	2 55	3 17
7	2 16	2 33	3 01	3 33	3 38	4 00
8	2 51	3 09	3 52	4 12	4 21	4 43
9	3 27	3 45	4 34	4 58	5 04	5 27
10	4 00	4 21	5 23	5 51	5 51	6 16
11	4 42	5 05	6 20	6 50	6 42	7 07
12	5 28	5 57	7 21	7 53	7 34	8 02
13	6 27	6 59	8 25	8 56	8 30	9 00
14	7 35	8 13	9 02	9 59	9 31	10 02
15	8 51	9 29	10 30	10 59	10 33	11 03
16	10 04	10 39	11 28	11 57	11 35	
17	11 02	11 44		0 25	0 04	0 34
18		0 12	0 52	1 16	1 02	1 28
19	0 40	1 05	1 40	2 04	1 53	2 15
20	1 30	1 53	2 26	2 39	2 36	2 55
21	2 15	2 34	3 00	3 23	3 13	3 29
22	2 52	3 10	3 39	3 55	3 46	4 01
23	3 27	3 42	4 12	4 29	4 16	4 32
24	4 00	4 18	4 47	5 06	4 47	5 03
25	4 36	4 54	5 26	5 46	5 19	5 37
26	5 14	5 36	6 07	6 30	5 56	6 15
27	6 00	6 25	6 52	7 16	6 37	7 00
28	6 58	7 18	7 43	8 11	7 25	7 52
29	7 47	8 16	8 39	9 04	8 21	8 52
30	8 44	9 13	9 31	10 01	9 24	9 59
31	9 42	10 10			10 35	11 26

Directions

Directions for the use of the foregoing Tide-table.

☉ stands for Sunday.

This Table may be made to serve the underwritten places by

Adding,	<i>h. m.</i>
For <i>Tinmouth-haven, Hartlepool, and Amsterdam</i>	0 30
<i>Brest</i>	1 00
<i>Silly</i>	1 45
<i>Mounts-Bay</i>	1 55
<i>Bridlington-Peer, and Humber</i>	2 00
<i>Fowey, Looe, and Plymouth</i>	3 10
<i>Weymouth, Dartmouth, Hamborough, and Hull</i>	3 30
<i>Torbay, and Tinmouth</i>	3 40
<i>Exmouth, and Topsham, and Lyme</i>	3 50
<i>Weymouth</i>	4 20
<i>Bridgwater, and Texell</i>	4 45
<i>Portland, Hareflew, and without the Ulie</i>	5 40
Subtracting,	
For <i>Leith, Maes, and Gouries-Gut</i>	0 15
<i>Gravesend, Rochester, and Rammekins</i>	1 00
<i>Buoy of the Nore, and Flushing.</i>	1 20
<i>Shoe-Beacon, Portsmouth, Redsand, and Ostend</i>	2 30
<i>Spithead, Harwich, Dover, Calice, Dublin</i>	3 00
<i>Orfordnesse, Gunfleet, Hastings, Shoreham, Deip</i>	4 00
<i>Needles, and Yarmouth-Peer</i>	4 40
<i>S^t Hellens, and Haver de Grace.</i>	5 30

Note, that when by reason of long Droughts in Summer, or continuall hard Frosts in Winter, the Fresh Waters are low, as also when the Wind blows hard at N. or N W. the Tides may hold up longer in the River of Thames, then the time shewed in the Table, by half an hour. But when the Wind blows hard at W. or W by S. or there are great Freshes; they hold not out so long by sometimes near half an hour.

The *Solu-*

dent triangles $\beta\gamma\alpha$, $\beta\gamma\epsilon$, join AE , and the thing is manifestly done.

The Calculation.

Assuming $\alpha\epsilon$ of any number of parts, in the triangles $\alpha\beta\epsilon$, $\alpha\gamma\epsilon$, the angles being given, the sides $\alpha\beta$, $\alpha\gamma$, $\epsilon\beta$, $\epsilon\gamma$ may be found by Trigonometry: then in the Triangle $\beta\alpha\gamma$, having the angle $\beta\alpha\gamma$, and the legs $\alpha\beta$, $\alpha\gamma$, we may find $\beta\gamma$. Then $\beta\gamma \cdot BC :: \beta\alpha \cdot BA :: \beta\epsilon \cdot BE :: \gamma\alpha \cdot CA :: \gamma\epsilon \cdot CE$.

The second Problem (Fig. 3 & 4.)

Three objects B, C, D , are given, or (which is the same) the sides, and consequently angles of the triangle BCD are given; also there are 2 points or stations A, E , such, that at A may be seen the three points B, C, E , but not D ; and at the station, E , may be seen A, C, D , but not B , that is the angles BAC , BAE , AEC , AED , (and consequently EAC , AEC ,) are known by observation: to find the lines AB, AC, AE, EC, ED .

Construction.

Take any line $\alpha\epsilon$ at pleasure, and at its extremitys make the angles $\epsilon\alpha\gamma$, $\epsilon\alpha\beta$, $\alpha\epsilon\gamma$, $\alpha\epsilon\delta$, equal to the correspondent observed angles EAC , EAB , AEC , AED . Produce $\beta\alpha$, $\delta\epsilon$, til they meet in ϕ , join $\phi\gamma$; then upon CB describe (according to 33. 3. Eucl) a Segment of a circle, that may contain an angle $= \gamma\phi\beta$; and upon CD describe a Segment of a circle capable of an angle $= \gamma\phi\delta$; suppose F the common section of these 2 circles; join FB, FC, FD ; then from the point C , draw forth the lines CA, CE , so that the angle FCA may be $= \phi\gamma\alpha$, and $FCE = \phi\gamma\epsilon$; so A, E , the common sections of CA, CE , with FB, FD , will be the points required, from whence the rest is easily deduced.

The Calculation.

Assuming $\alpha\epsilon$ of any number, in the triangles $\alpha\gamma\epsilon$, $\alpha\phi\epsilon$, all the angles being given, with the side $\alpha\epsilon$ assumed,

sum'd, the sides $\alpha\gamma$, $\epsilon\gamma$, $\alpha\phi$, $\epsilon\phi$, will be known; then in the triangle $\gamma\alpha\phi$, the angle $\gamma\alpha\phi$ with the legs $\alpha\gamma$, $\alpha\phi$ being known, the angles $\alpha\phi\gamma$, $\alpha\gamma\phi$ with the side $\phi\gamma$ will be known: then as for the rest of the work in the other figure, the triangle BCD having all its sides and angles known, and the angles BFC , BFD , being equal to the found $\beta\phi\gamma$, $\beta\phi\delta$; how to find FB , FC , FD by *Calculation* (and also *Protraction*) has been shewn by Mr Collins (in *Phil. Transactn.* 69 p. 2093.) as to all its cases, which may therefore supersede my shewing any other way.

But here it must be noted, that if the sum of the observed angles, BAE , AED , is 180 degrees: then AB and ED cannot meet, because they are parallel, and consequently the given solution cannot take place; for which reason I here subjoin another.

Another Solution.

Upon BC (Fig. 5.) describe a segment BAC of a circle, so that the angle of the segment, may be equal to the observed $\angle \beta\alpha\gamma$, (which as above quoted is shewn 33. 3. Euclid) and upon CD describe a segment CED of a circle, capable of an angle equal to the observed $\angle CED$; from C draw the diameters of these circles CG , CH ; then upon CG describe a segment of a circle GFC , capable of an angle equal to the observed $\angle AEC$; likewise upon CH describe a circles segment CFH , capable of an angle equal to the observed $\angle CAE$: suppose F the common section of the two last circles HFC , GFC , join FH , cutting the circle HEC in E , join also FG , cutting the circle GAC in A : I say that A , E , are the points required.

Dem :

For the $\angle BAC$ is $= \beta\alpha\gamma$ by construction of the segment, also the angles CEH , CAG , are right, because each exists in a semicircle: therefore a circle being described upon CF as a diameter, will pass thro E , A ; There-

fore the angle $\angle CAE = \angle CFE = \angle CFH =$ (by construction) to the observed angle γ_{ae} . In like manner the $\angle CEA = \angle CFA = \angle CFG =$ observ'd angle γ_{ea} .

If the stations A, E fall in a right line with the point C ; the lines GA, HE being parallel, cannot meet: but in this case the problem is indeterminate and capable of infinite Solutions. For as before upon CG describe a Segment of a circle capable of the observed $\angle \gamma_{ea}$, and upon CH , describe a Segment capable of the observed γ_{ae} : then thro C , draw a line any way cutting the circles in A, E , these points wil answer the question.

The Third Problem.

Four points B, C, D, F , (Fig. 6.) or the 4 sides of a quadrilateral, with the angles comprehended are given; also there are 2 stations A and E such, that at A , only B, C, E are visible, and at E only A, D, F , that is, the angles BAC, BAE, AED, DEF are given: to find the places of the two points A, E ; and consequently, the lengths of the lines AB, AC, AE, ED, EF .

Construction.

Upon BC (by 33. 3. Eucl.) describe a segment of a circle, that may contain an angle equal to the observed angle BAC , then from C draw the chord CM , or a line cutting the circle in M , so that the angle BCM may be equal to the supplement of the observed angle BAE , i. e. its residue to 180 degrees. In like manner on DF describe a segment of a circle, capable of an angle equal to the observ'd DEF , and from D draw the chord DN , so that the angle FDN may be equal to the supplement of the observ'd angle AEF , join M, N , cutting the 2 circles in A, E : I say A, E , are the two points requir'd.

Dem:

Join AB, AC, ED, EF , then is the $\angle MAE = \angle BCM$ (by 21. 3. Eucl.:) = supplement of the observ'd $\angle BAE$ by construction, therefore the constructed $\angle BAE$

$\angle BAE$ is equal to that which was observed. Also the $\angle BAC$ of the segment, is by construction of the Segment, equal to the observ'd $\angle BAC$. In like manner the constructed angles AEF , and DEF , are equal to the correspondent observed angles AEF , DEF , therefore A, E are the points required.

The Calculation.

In the Triangle BCM , the $\angle BCM$ ($=$ supplement of BAE) and $\angle BMC$ ($= BAC$) are given, with the side BC ; thence MC may be found; in like manner DN in the $\triangle DNF$ may be found. But the $\angle MCD$ ($= BCD - BCM$) is known with its legs MC, CD , therefore its base MD , and $\angle MDC$ may be known. Therefore the $\angle MDN$ ($= CDF - CDM - FDN$) is known, with its legs MD, DN ; thence MN with the angles DMN, DNM , will be known. Then the $\angle CMA$ ($= \angle DMC + DMN$) is known, with the $\angle MAC$ ($= MAB + BAC$) and MC before found; therefore MA and AC will be known. In like manner in the triangle EDN , the angles E, N , with the side DN being known, the sides EN, ED will be known; therefore AE ($= MN - MA - EN$) is known. Also in the triangle ABC , the $\angle A$ with its sides BC, CA being known, the side AB will be known, with the $\angle BCA$; so in the triangle EFD , the $\angle E$ with the sides, ED, DF being known, EF will be found, with the $\angle EDF$. Lastly in the triangle ACD , the $\angle ACD$ ($= BCD - BCA$) with its legs AC, CD being known, the side AD will be known, and in like manner EC in the triangle EDC .

Note that, in this problem, as also in the first and second, if the two stations fall in a right line with either of the given objects: the *locus* of A , or E , being a circle, the partiicular point of A , or E , cannot be determined from the things given.

As to the other cases of this third problem, wherein A , and E , may shift places, i. e. only D, F, E may be vi-

sible at *A*, and only *A, B, C* at *E*; or wherein *B, D, E*, may be visible at *A*, and only *C, F, A*, at *E*; or wherein *A* may be of one side of the quadrilateral, and *E* on the other; or one of the stations within the quadrilateral, and the other without it: I shall for brevity's sake omit the figures, and diversity of the Signs $\pm$ and $--$ in the calculation, and presume that the Surveyour will easily direct himself in those cases, by what has been said.

The Solution of this third problem is general, and serves also for both the precedent. For suppose *C, D* the same point in the last figure, and it gives the solution of the second problem: but if *B, C*, be suppos'd the same points with *D, F*, by proceeding as in the last, you may directly solve the first problem.

A Letter from William Molyneux Esq; to one of the Secretarys of the R. S. concerning the Circulation of the blood as seen, by the help of a Microscope, in the Lacerta Aquatica.

Dublin Octob. 27. 1685.

Sir,

OUR Society lately received transcripts of two of Dr *Gardens* Letters, the first dated from *Aberdeen* July 17. 1685. to Dr *Middleton*; the other Sept. 4. 1685. to Dr *Plot*. To both these Letters I have something to say.

In the first he gives an Account of the Visible Circulation of the blood in the *Water-Newt* or *Lacerta Aquatica*; truly I am heartily glad, that this Learned and Ingenious Dr has hit upon this Experiment; tis now above two years and an half, since I first Discovered this surprising

prising appearance, and wrote a large account thereof May 12. 1683, as also of the whole Anatomy of this Animal, to my Brother, who was then at *Leyden*. And I have since that, shew'd it frequently, both on the out-side without Dissection, and in the inward Vessels also, to several Curious *Physicians* and *Philosophers*, to their great satisfaction and admiration; particularly I expos'd it first to our *Society* May the 26. 1684. as appears by the following Minute taken from our Registry. May 26. 1684. *Mr. Molyneux* opened before the Company a Water-Newt, which he takes to be the *Salamandra* or *Lacerta Aquatica*, in the body of this Animal there are two long *Sacculi Aerei*, on which the blood Vessels are curiously Ramified, to these blood Vessels applying a Microscope, he shew'd the Circulation of the blood ad Oculum, as plainly as water running in a River, and more rapidly then any common Stream. The same experiment I repeated again before them on the 2d of June following, and to those that had good observing Eys, the Circulation was as visible outwardly on the hands and toes, as in the Vessels within. But Certainly the Appearance in the Vessels on the two forementioned sacculi, with the beating, emptying & filling of the Heart, is most surprising to the beholder. This Creature seems wonderfully adapted by Nature for this Experiment; for besides the transparency of its Skin and Vessels, I have had them live nine hours after they have been Expanded, and all their Viscera laid open. I send you herewith the Figures of the Animal. Fig. 7th. Tab. 1. shews the Intire Body of a Male, for the Female is not so strongly spotted. Fig. 8th. Tab. 1. is Rudely drawn, but a Represent the *Sacculi Aerei*.

To Dr *Gardens* 2^d. Letter I have only this, he in-
deavours therein to explain and give an Account of the
Trade Winds within the Tropicks from the different gra-
vity of the Atmosphere at divers times of the Year. And
yet it is asserted numb. 165. pag. 790. of the *Philos.*
Transactions,

Transactions, that the Mercury is not affected with the weather, or very rarely, let it be Cloudy, Rainy, Windy, or Serene in St Helena, or the Barbadoes, and therefore probably not within the Tropicks, unless in a Violent storm or Hurricane. Now if the Mercury move little or nothing in the Baroscope, tis likely there is little or no Change in the Gravity of the Atmosphere within the Tropicks.

I am,

Your most Humble Servant,

WILLIAM MOLYNEUX.

Part of a Letter from Dr. Nath. Vincent. F. of the R. S. concerning Dr Papin's way of Raising Water.

I Have inquired into Dr *Papins* Problematic Engine for raising Water, in the *Transaction* of July 1685, and do conclude it may be solved after this manner. Within his Rock *G C* (see *Phil. Transf.* Num. 173, Fig. 18th.) there may be a Vessel placed, which shall be made like the Body of a pair of Bellows, or those Puffs heretofore used by Barbers, which being filled with water, a piece of Clock-work put under it may produce the Jetto's; the water being received into the Shell *HH*, and running thence into the hollow of the Coral *EE*; may be thereby conveyed into the follicular cavity, in the same quantity it is ejected from the two
Emerging

Emerging Tubes; and it shall circulate a hundred or more then a thousand times, according to the going of the Clock-work. If some such account as this will unriddle the Engine, the contrivance of it is owing to a Theory communicated by my self, &c.

A Letter of Mr. R. A. relating to the same subject.

I have here given you a rude Draught of *Monfr Papins* curious Experiment, hoping thereby to have my conception of it more readily understood; if it carry not with it some appearance of reason, I desire you to suppress it, and you will much oblige, &c.

I conceive, that the *Air* is forced into the outer glass at the bottom thereof.

That it then passes up between the two Glasses.

That the outer glass or case being close luted at the Head or Crown to which the inner Glass is hung by the Corall, the *Air* is forced into the mouth of the Inner Glass.

That the *Air* so forced pressing on the surface of the Water that covers the Rock, forces the Water to rise thro those two extream parts that are not at all clog'd, or cover'd with Water.

I am, &c.

Observations of Dr Papin, Fellow of the Royal Society, on a French Paper concerning a Perpetual Motion.

THE Paper printed in *French* and containing a contrivance for a perpetual motion, being set down in such a manner, that can hardly be understood but by those that are much acquainted with such descriptions: I have endeavour'd to explain it as follow's.

Let *DEF* Fig. 9. be a pair of bellows 40 inches long, that may be open'd by removing the part *F* from *E*: let them be exactly shut every where but at the aperture *E*; and let a pipe *EG*, 20 or 22 inches long, be soldered to the say'd aperture *E*, having its other end in a Vessel *G*, full of Mercury, and placed near the middle of the bellows's.

A, Is an axis for the bellows's to turn upon.

B, A counterpoise fastened to the lower end of the bellows's.

C, A weight with a clasp to keep the bellows's upright.

Now if we suppose the bellows's open'd only to $\frac{1}{3}$ or $\frac{1}{4}$ standing upright as Fig. 9th. and full of Mercury, it is plain that the sayd Mercury being 40 inches high, must fall, as in the Torricellian experiment, to the height of about 27 inches, and consequently the bellows's must open towards *F* and leave a vacuity there: this vacuity must be fill'd with the Mercury ascending from *G* through the Pipe *GE*, the sayd Pipe being but 22 inches long: by this means the bellows's must be opened more and more till the Mercury continuing to ascend make's the upper part of the bellows's so heavy, that the lower part must get loose from the clasp *C*, and the bellows's should turn quite upside down; but the Vessel *G* being set in a convenient place keeps them horizontall as Fig. 10, and the
part

part *F* engageth there in another Clasp *C*; then the Mercury by its weight runs out from the bellows into the Vessel *G* through the Pipe *EG*, and the bellow's must shut closer and closer untill the part *EF* comes to be so light, that the counterpoise *B* is able to make the part *F* get loose from the clasp *C*; then the bellow's come to be upright again as Fig. 9th; the Mercury left in them fall's again to the height of 27 inches, and consequently all the other effects will follow as we have already seen, and the motion will continue for ever. Thus much the *French Author*;

Upon this it is to be observed; that the bellow's can never be opened by the internal pressure, unless the sayd pressure be stronger then the externall: now in this case the weight of the *Atmosphere* doth freely press up the outward part of the bellow's, but it cannot come at the inward part but through the Pipe *GE*, which containing 22 perpendicular inches of Mercury, doth counterpoise so much of the weight of the *Atmosphere*, so that this being supposed to be 27 inches of Mercury, it cannot press the inward part of the bellow's but with a weight equivalent to 5 perpendicular inches of Mercury. From this we may conclude, that the pressure of the *Atmosphere* being weakned within the bellow's, more then it can be helpt by the Mercury contain'd in the same, as may easily be computed; the sayd bellow's standing upright as Fig. 9th; must rather shut then open. Thus, without loosing any labour and charges in trying, people may be sure that the thing can never do.

EDVARDUS BERNARDUS *de Mensuris*
& Ponderibus καὶ ᾠκισμῶν. Oxonii è Theatro
 Seldonio A. D. 1685.

THIS Compendious Treatise, inscrib'd to Dr *Pock* the Venerable Sanctuary of Orientall Learning, and also annexed to his excellent Comment on the difficult Prophet *Hosea*, recommends to the diligence of Posterity the Berries and Kernels of fruits, the uniform Cells of Bees, and chiefly the Pendulum of the right famous *Galileo*, to conserve the true models of Commutative Justice. But for the ages past refers especially to the ancient Coyns still kept in great plenty in the Cabinets of Christian *Princes*: besides the rules of the *Theaters*, *Amphitheaters*, *Temples* and *Aquæducts*, &c, of *Europe* and *Asia* and *Africa*, which have happily born the strokes of time and *Barbarity*, and have of late been exactly measured by noble and skillfull Travellers: as the Pantheon at *Rome*, *Minervas* Temple in her own City, the numerous Antiquitys of *Constantinople*, the admirable Ruine of *Chilmenar*, and the perpetuall Pyramids of *Egypt*. From these and severall other Monuments is asserted the equality of the *English* foot to that of the *Hebrews*, *Babylonians*, *Greeks*, *Chineses*, *Castilians*, and those of *Lisbon* and of *Lyons*. And farther that allowing an intire *English* foot 1000 parts, the Parisian will reach 1066, the Catholic foot of *S^t Jonas Moor* 1089; the old Roman 970; that of *Villalpandus* deriv'd from *Vespasians Congius*, 986; the Rhinland foot of *Snellius* 1033; the Venetian 1140; the Bononian of Mr *Auzout* 1140; to omit the rest. Thus from the foot & most proper rise, passing through the various measures of Antiquity, this Treatise at last gives for one Degree, or the $\frac{1}{360}$ part of the Circuit of the whole Earth, $73\frac{4}{15}$ *English*

glifh miles, of 5000 foot in a mile: $67\frac{4}{10}$ Catholic miles, $66\frac{1}{3}$ Arabic miles, juſt according to the old obſervations of *Haſan*, *Nodham*, *Mafudy* and other *Arabs*; and little differing from the late Experiments of the diligent and ingenious Mr *Normood* in *England*, and Mr *Picart* in *France*. As for ancient Weights; the true Hebrew *Secel*, or *Siclus Argentus* inſcrib'd with Samaritane Characters, is equal to three ſhillings *Engliſh*, or to the Tetradrachm of *Thaſus* and the Greek Iſlands. The Attick Tetradrachm makes two Shillings & nine pence *Engliſh*, or four *Denarii Gordianici*. The *Denarius Conſularis Romanorum* bears $7d\frac{1}{2}$. *Engliſh*. The *Denarius Tiberianus* $7\frac{1}{4}d$. And laſtly the *Denarius Veſpaſianicus* $6\frac{1}{2}d$ c. Hence alſo is found the value of an Hebrew Talent in Silver to be 450*l*. Sterling, and that of Gold to riſe to 5400*l*. Sterling. But for the meaſures of Capacity from the *Cheme* to the *Achane*, I refer you to the Book it ſelf: only advertiſing, that the Hebrew *Epha* or *Batus* is ſo far from agreeing with the *Væba* of the *Arabs*, (that is the weight of 32 or 34 Rotuls or pounds,) that it contains of water no leſs then 76 pounds Troy; which is juſt the Cube of the *Engliſh* foot in that Liquid. And alſo that the Hebrew Cubit, (for this and the *Epha* are the *Jachin* and *Boaz* of a late *Essay to recover the Jewiſh Weights and Meaſures*;) falls ſhort at leaſt three inches of the Cubit of Grand Cairo, taken by Dr. *John Greaves* the renowned Reſearcher of Antiquity. In fine the *Engliſh* Halfe foot in Braſs compared with the moſt famous of other Countreyes, by an Ordinary Care of the Rowling Preſs may be truly wrought off and repreſented. See Fig. 11th

Ant. Nuck *de Ductu Salivali novo, Saliva, Ductibus Aquosis, & Humore Aqueo. Lugd. Bat. 86.*

THIS Ingenious *Anatomist* divides this little tract into two parts; in the first whereof he gives us his discovery of a new Gland, with its proper *Ductus*; his observations on the *Saliva*; with an historical account of the *Ductus Salivalis* when disordered. This Gland is seated in the Orbit of the *Ey*, just between the *Musculus Abducens*, and the uppermost part of the *Os Jugale*; it is of no certain figure, being sometimes oblong, sometimes almost round, or oval, and sometimes triangular; it exceeds not the bigness of a small Nut, or the weight of half a *drachm*, or two *Scruples* at most; it hath four sorts of Vessels beside that peculiar to it; an Arterie from the Carotid; a Vein from the Jugular, and its Nerve springs from the third pair called *Motorii oculorum*; and he does not question, but it has Lymphatics also; There are many small sprigs rise from this Gland and meeting together joyn all in one *Ductus*; which crossing the *Ductus Stenonianus* passeth directly downward on the outside of the *Os Maxillare*, and opens upon the last tooth but one of the *Dentes Molaris* of the uppermost Jaw. Our *Author* gives it the name of *Ductus Salivalis Superior alter*, in opposition to that of *Steno*. He ascribes no use to its *Saliva* but what is common to the other, *viz.* to Moistten the parts; to quicken the tast, and by its more intimate mixture with meats, &c. to promote fermentation, as also upon extraordinary occasions to facilitate Salivation.

In the second part of his Book, he gives us an account of certain *Ductus*'s, that carry water to the Eys; having the first time accidentally happened upon one in the *Galeus*; he traced it along on the outside of the *tunica Sclerotis*

Sclerotis, till it entred that part of it called the *Cornea* : it easily admitted a Probe ; but nothing issued forth after the Probe was out, because as he supposes (tho' there be no valve to be found in any part yet) the extremity of the *Ductus* serves as a Valve, and discharges its matter after the same manner as the *Ductus Communis*, the *Ureters*, &c. doe into their respective cavitys, without admitting regurgitation. He has found in Dogs and Birds two in each Ey exactly opposite one to the other ; in some Sheeps Eys five, in others six : but he can by no means discover their rise, being able to trace them as far as the optick Nerve, but very little farther ; he assures us Mankind also are not without them ; all which he confirms by Experiments made both on Men and beasts.

The General Bill of *Christnings* and *Burialls*, according to the report made to his *Majestie*, by the Company of Parish-Clerks of *London*. 1685.

Christned	{	Males. ————	7484.
		Females. ———	7246.
		In all. ————	14730.

Buried	{	Males. ————	11891.
		Females. ———	11331.
		In all. ————	23222.

Jo. Con. Peyerii, *Merycologia, sive de Ruminantibus & Ruminatione Commentarius*, Basileæ. 4°.

THE Learned *Author* observing that *Rumination* has not been handled as it ought, and that many of those creatures which *Ruminate* are very serviceable to Man-kind, (but especially to his Country-men the *Swissers*,) is pleased to make this matter the Subject of a Treatise consisting of 3 Books; in the first of which, after a Division of Animals into *Ruminantia* & *non Ruminantia*, he reckons up those of the former kind; some of which he says, may more properly be said to *Chew the Cud*; others *imitate* that Action, and are here call'd *Ruminantia Spuria*, as the Mole-Cricket, Bee, Beetle, Crab, Lobster, Mullet, and several Birds: but the creatures which *Ruminate* in a more genuin sense, are, among Quadrupeds, the Ox, Deer, Sheep, and Goat kind, the Camel, Hare, and the Squirrel; also some Men; of whom he gives several instances.

In the Second Book, he treats of the Organs subservient to *Rumination*; as of the several Stomacks belonging to some of the *Ruminantia legitima*; and of them first in general; then in particular of the *Paunch*, *Reticulus* (Κερίφραλλον) the *Feck*, the *Read*; of the single Stomach in Hares, and Rabbits; all which are described with great exactness, and after a very satisfactory manner.

As to the Stomacks of the *Ruminantia Spuria*; he affirms they all have spiral musculoſe Fibres, by means of which they do (as it were) grind and work their meat, up and down, after a manner somewhat analogous to *Rumination*; for the better effecting of which, in some of them the Stomack is extreamly rough in the inside, as in the *Mullet*; in others it is very hard and callous, as
in

in Geese, Hens, &c. in the Stomack of others, (as of the Cricket, and Lobster,) there are Teeth.

After this he passes to the *Oesophagus*, as it is in the *Ruminantia genuina*; where rejecting the account which *Petrus Aponensis*, *Amylianus*, *Aquapendent*, and even *Fallop* has given of that part, he describes it (according to *Steno*) to consist chiefly of 2 spiral muscles form'd like screws, crossing one another. Which sort of make he thinks conduces much to the strength necessary for the carrying meat up and down in that part, in so quick a manner as is requisite.

From the *Oesophagus* he goes to the *Mouth*; of which he mentions such particulars, as seem to be instrumental in *Rumination*; for example, the volubility of the Tongue, rowling the meat up and down in the mouth; the viscosity of the Spittle, keeping it together; the admirable contrivance of the Teeth, &c.

He also reckons up those parts, which assist more remotely in *Rumination*, as the muscles of the Breast and *Abdomen*, and the *Diaphragm*.

To this he subjoins Cutts, representing the four Stomacks of such Creatures as are *Ruminantia bisulca*, the single Stomack of the Rabbit, and the *Oesophagus* of an Ox; the muscular fibres of all which are well traced, and their windings exprest in the Figures.

In the 3d. Book he inquires into the Etymology of the word *Rumination*; and defines the thing to be (in Brutes) a *Natural motion of the Stomack, Mouth, and other parts subservient hereunto, relieving one another in this action; by which the meat, which was eaten rudely and (as it were) in haste, is convey'd back to the mouth again, chewed there, and then swallow'd a second time, to the great advantage of the Animal*: that this motion is *natural*, he proves from a *History in Galen*, who having preserved a Kid taken out of the *Uterus* of the Dam upon dissection, and bred it by its self, observed that when it

came to eat hard meats, it *Ruminated* like other Goats.

The cheif motive to *Rumination* seems to be the hardness and grossness of the meat, as swallowed at first; the Stomack being not able to master it, unless it be more thoroughly masticated: hence Cattel *chew* the *Cud* more frequently in Winter when they feed on hay, stubble, &c. then in Summer when on grass; and Calves, &c. do not *Ruminate* at all, as long as they live on milk.

Rumination in Men proceeds, as he thinks, either from the imagination of the Mother being intent on this action, or from some ill habit of vomiting, and swallowing the meat again; the cure of it in men, (where it is preternatural) consists in a small quantity of meat easily digested, chewing it well, and walking gently after eating: liquid meats are preferd before solids, especially at the beginning, to break the habit.

He treats of the Food of *Ruminating* Creatures, and their manner of Feeding; of the advantage they are to Mankind, and this action is to them, and consequently to us, as being that which conduces much to the strength and health of both them and us.

As to the Impediments of *Rumination*, they are generally three; some disease or else an excess, or ill quality of the food; if excess be the cause, the *Author* saies it will give present releif, to thrust in your arm as far as you can, and pull out some of the food, and afterwards to drive the beast up and down, not suffering him to drink.

At last (by way of *Appendix*) the *Author* adds Letters from *Webferus*, *Wagnerus*, *Harderus*, and *Muraltus*, concerning the aforesaid subject.

Castorologia à Jo. Mario, *aucta* à Jo. Franco. Aug.
Vindel. 85. 8°.

THIS Treatise of the nature of the *Castor*, being composed many years ago by *Joannes Marius*, Physician at *Ulm*, is not only published, but enlarged by *Joannes Francus*, who out of several Manuscripts, and his own observations, has put the last hand to this Book. It begins with a contemplation of the great usefulness to mankind of things common and contemptible, which serves for an introduction to the Natural History of an Animal of more real use, than value. It is handled according to the Method prescribed by the German *Naturæ Curiosæ* in single subjects, where after the different appellations in several Languages and pretended Etymologies of them, he describes the *Beaver* (for it is not our *English Badger*, for which the Author mistakes it) to be an Animal about the bigness of a Cat, amphibious and living upon fruits and barks of trees: his forefeet are like a Dogs, and his hinder like those of a Goose; his tail seems to be an intire Fish, which he always keeps wet, suffering several inconveniences when it is dry. Between its hinder legs grow two bags, which contain the *Castoreum*; these many Authors took for the Testicles of the Animal, till *Rondeletius* first undeceived the world, & proved them by Anatomy to be only bags for this very substance; the reasons of this you have here given you. And after an account of the manner of its feeding, building its nest, bringing forth its young, its age, and places where most frequently found, you have the medical use of several of its parts, as of its Skin which is commended in the Colick, Hysterical pains, Madness, and other distempers, especially in all those commonly accounted Cold; as is likewise the Fat. The blood is sovereign in

R r r 2 the

the Epilepsy, inward bruises, hardness of the breasts & the like. The Fur, (besides the mechanickall use of it in hats) is astringent, and stops blood. The teeth are used as Amulets for Children in breeding the Teeth, in the Pleurisy, and to prevent the falling-sickness in Infants. But the chief thing of use about it is the *Castoreum*, which being first described by its sensible qualities, which direct how to distinguish the native from that which is adulterated, all the effects of it in Physick are very particularly enumerated; various receipts for most distempers, backt with the experience of the Physicians who successfully used them, are carefully delivered; which to set down here singly would be to transcribe a great part of the book. All which is so learnedly and faithfully done, and that alternately by *Marius* and *Francus*, that it seems a contention between two very good Naturalists, to give a just account of one of the best Medicines in Nature: at the end of it is a Catalogue of the Manuscripts which are quoted in the book, some of which have been since Printed, and the rest we may expect from the publisher of this usefull tract.

*Printed at the Theater in Oxford for Sam.
Smith, at the Princes Arms in Paul's
Church-yard London; and Hen. Cle-
ments Book-seller in Oxford.*

F I N I S.

PHILOSOPHICAL

TRANSACTIONS.

For the Month December, 1685.

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An Explanation of the Cutts of two Porphyry Pillars in Ægypt.

TAB. 1. Fig. 1. represents the *Obelisk*, or *Aiguille*, near the *Matarea*, about 3 or 4 miles from *Cairo*. The height of this Pillar is 67 foot: the bigness 7 and $\frac{1}{3}$, with the *Hieroglyphic* Character.

o o shews the height of the *Nile's* rising above the superficies of the Earth, when it overflows.

Tab. 1. Fig. 2. The *Needle* at *Alexandria*.

These Pillars are more fully describ'd in the *Phil. Transf.* Numb. 161. Their Figures, being no where extant that we know of, are here presented to the Reader. who is obliged for them to the Reverend Dr *Huntington*.

Acus Magneticæ variationis, quæ Norimbergæ paucis abhinc annis deprehensa fuit, Observatio anno currente 1685, ibidem ab Observatoribus Doctore I. G. Volckamero, I. P. Wurtelbaur, & G. C. Eimmart repetita; & Regiæ Societati Lond. à Clariss. D^o. And. Arnoldo, Norimbergensi, communicata.

INventa de novo linea Meridiana, sicut olim, non una, sed pluribus, partim vulgari modo, partim methodo *Heveliana*, partim etiam propria, in planis marmoreis ad libellam decenter exæquatis, diversarum mediocriter longitudinum (prout ex Epistola invitatoria Cl. *Sturmii* tunc edita videre est;) designabatur insuper alia longior in plano exacte horizontali, ad intervallum radii 12. pedum *Noricorum* ductus arcus, pro distinctiori gradus in sua minuta divisione: Locus idem, qui antea, maxime idoneus eligebatur; erat spatium peramplum, sub dio liberrimum, nullisque latentis magnetismi vel ferri vicini fallaciis obnoxium, in horti nempe amæna planitie, cujus areæ quadratæ unum latus ducentos pedes exsuperat: in hujus spatii medio singulæ Meridianæ omni, qua fieri potuit, cura ac circumspeditione investigatæ, ab observatoribus rigidissime examinabantur; & continuis aliquot diebus sub initium mensis *Augusti*, (tempora quidem solstitialia, huic operationi magis accommodata, destinata fuerant, sed inclementia cœli differre coegit) idem consensus Meridianarum, non neglecto tamen respectu tunc temporis declinationis ☉, diversimode explorabatur,

Postea quam de certitudine Meridianarum tali pacto securi redditi, applicatis variis pyxidibus magneticis, tam iis vetustioribus, quæ ante quinquennium huic usui adhibebantur

hibebantur, quam aliis recentioribus plurimis, mediocris quidem longitudinis, quarum maximæ semissem pedis non excedebant, sed gracilioribus & vivacibus, animadvertebamus, quod mirum, declinationem acus à pristina nec in uno minuto discrepare, sed in quavis meridiana exacte cum priori convenire, ad Occas. scilicet 5°. 5'. An autem interea temporis ulterius processerit, ut nunc in situ retrogrado ejus deviatio deprehensa fuerit, quod certe casu evenisse potuisset, non liquet, cum nec temere istud statuere, quin in eam sententiam, quod stationarius (procul dubio circularis motus) in eodem puncto permanferit, pronius abire velimus.

Ita D. Eimmartus perscripsit ad amicum suum *Andream Arnoldum*, qui isthæc *Regiæ Societati Londinensi*, *Fau-trici* olim suæ, lubens meritoque transmittit.

A Letter, subscribed W. Tenon, concerning Dr Papin's new Water-Engine.

SIR,

THE other day, upon reading in the *Transactions*, a description of the effects of a *Water-Engin*, invented by Dr *Papin*, and propounded as a *Probleme* to find out the contrivance, there came into my mind the following thought. I do not think it is the same with his, nor so good, but such as it is I send you, because variety of fancies gives hints many times to better new inventions.

Tab. 1. Fig. 3. *ABDE* signifies a cylindrical Vessel, closed

closed on every side, and divided into two rooms by the floor *EF*.

GLMH, is another Cylindrical Vessel within that upper room, cemented with its mouth downwards to the floor, and full of water up to the surface *IK*; the upper part thereof *G I K H*, being full of Air.

OQ, *RP* two Pipes, open above and below, and let through the upper room into this Vessel, and reaching almost down to the floor *EF*.

UV a Pipe open above and below, and let into the upper room. These Pipes must be close joyned round about them to the floors *CD*, and *GH*.

X, *Y*, two little hemispherical bladders, prepared with Oyl or some Oily substance (as Butter or Turpentine) against water, and cemented with their Mouths upward to the floor *EF* underneath.

α , β two valves opening out of the upper room into the bladders.

γ , δ two other valves opening out of the bladders into the inner Vessel above.

NZ a pendulum playing upon the center *N*, and having two battledoor arms *a b* to squeeze alternately the bladders which rest upon them.

Let the upper room be filled with water at the Pipe *UV*, and if the pendulum be made to play by Clockwork, the bladders will perpetually pump it thence into the inner Vessel, and the compressed Air *G I K H* in the upper part of that Vessel, pressing upon the surface of the water *IK*, will force it thence into the Pipes *OQ*, *PR*, out of which spouting with a perpetual even stream into the spoons *S*, *T*, it will run down by the Pipe *WU*, into the upper room again. The pendulum will play most easily when the upper room is filled to the top of the Pipe *WU*. Instead of the bladders may be other contrivances, as of suckers or little Organ bellows, playing alternately with two leaves about an axis in the middle.

Sept. 16. 1685. *W. Tenon.*

T t t

Eclipses

*Eclipsis Lunæ totalis cum Mora, Anno 1685. die
10 Decemb. St. N. observata Gedani à JO-
HANNE HEVELIO.*

CUM Observationes Eclipsium Lunæ, inprimis to-
talium cum mora, ad restaurandas & promoven-
das Res Astronomicas, plurimum contribuant, ac ra-
ro nobis in conspectum prodeant; utique summe ne-
cessarium, ut quilibet Astrophilus ad eas omni indu-
stria attendat: Ideoque & ego, qui à plurimis jam re-
tro annis Rebus Cælestibus pro meo à Deo concesso
modulo operam dedi, volui & huic notabili deliquio in-
vigilare; sed vix spes aliqua dabatur, de eo vel quic-
quam obtinendi; siquidem non solum initium Decem-
bris, verum etiam totus fere November continuo nubi-
losus, & impetuofus extitit; nihilominus tamen præter
omnem spem, decimus Decembris à summo mane Cœ-
lum admodum ferenum, & ab omnibus nubibus prorsus
denudatum exhibuit, ut rursus animi nobis adderentur,
hanc observationem ex Voto, procul omni dubio suc-
cessuram.

Proinde, statim exorto sole ad hæc operas nos ac-
cinximus, non solum Horologia Ambulatoria, quam Of-
cillatoria, ad normam Sciatericorum singula minuta
commonstrantium rectificando, sed pariter nonnullas
Altitudines Solis, Quadrante nostro singula minuta ex-
hibente, capiendo; & quidem primo Solis Altitudi-
nem Meridianam, atque post Meridiem, tam Altitu-
dinem solis, quam Capellæ, pro corrigendo tempore ex
horologiis, Aere existente quidem admodum fudo, sed
vento satis austero, ut difficultate jam aliqua observa-
tiones expedirentur; spretis tamen his omnibus, ut ini-
tium ingruentis Eclipsios recte exciperem, omnem ad-
hibui operam, instruendo Tubos scilicet Opticos varii
generis,

generis, tam longiores, quam breviores; verum optime prævidens, Telescopia, 12, 20, & 30 pedum, etiamsi in specula mea ad manus adessent, ob Ventum nimis impetuosum, fore hac vice inutilia, eo partim attento, quod erectis fulcris ac perticis minime firmiter alligari, partim ob situm Lunæ altiorem maxima cum difficultate erigi, & dirigi possent. Quamobrem breviores Tubos 5, 6, & 7 pedum ad manus sumpsimus; sed nec his omnem incommoditatem, ob istum impetuosum Ventum evitavimus: profecto artis laborisque haud exigui erat, Telescopia adeo firmiter continue ad Lunam retinere, ut penumbram recte discernere potuerimus, Phasesque omnes exactè designare, per quas nimirum maculas transirent, vel quas omni tempore attingerent. Attamen pro viribus, quousque severa tempestas, atque transeuntes nubeculæ permittebant, rem peregi, sæpius non istas Phases, quas exoptabam, sed eas, quas Cælum concedebat describere oportuit. Nihilominus, Divina ope, licet Aere adeo existente turbulento, variaque obstacula sæpius intervenirent, adhuc 23 Phases si initium Eclipses, totalem obscuracionem, & Recuperacionem luminis non excipias, obtinui.

Ubi imprimis notandum habes, quod densissima penumbra genuinum Initium Eclipses præcesserit, ab hora circiter dimidia decima, ita ut vix ac ne vix verum initium discernere quiverim; deinceps vero, umbra paullo promotiore, phases aliquanto distinctius designare licuit. Colorem porro quod attinet, hunc in hac Eclipsi maxime notandum habes; quippe talem diversitatem raro admodum in ipso colore deprehendi: modo enim erat Ferrugineus, vel Mustelinus; ingruenti vero totali obscuracione, Limbus Lunæ circumcirca erat sublividus, ex parte sublustris, & rubicundus; verum in Lunæ medio, quasi satis densa, & obscura nubecula conspiciebatur, ut vix maculas recte in Luna distinguere potuerimus; quæ nigricantior umbra paullatim succe-

sive versus dextram, & Paludem Mœotidem promovebatur, sic ut circa initium Recuperationis luminis, tota genuina umbra admodum obscura, & nigricans apparet, atque circa ultimam annotatam phasin, reliqua pars adhuc obscurata Lunæ, sive ejus limbus, hora videlicet prima noctis, neutiquam deprehendi vel minimum potuerit. Exoptassem, ut obscuriores densissimæ nubes non exortæ fuissent, totumque cœlum non penitus obduxissent, quo porro ad finem usque observare nobis licuisset, quid ratione coloris, umbræ, atque penumbær accidisset.

Itaque in hac Eclipsi non nisi ejus Initium, 16 phases crescentes, cum initio Recuperationis luminis, atque quatuor decrescendentibus Phasibus observare ac denotare concessum fuit; sicuti Observationum Tabella nostra hic annexa, Typusque Eclipses clare ostendit, (vide Tab. 2. Fig. 1.) nec non per quas maculas quælibet phasium sectio transierit, tum quid præterea notatu dignum extiterit. An alibi cœlum magis extiterit propitium, alique multo plures Phases determinare, atque longe accuratiores ex cœlo depromere valuerint, tempus docebit; profecto si cœlum nobis magis annuisset, lubentissimo animo etiam aliquid amplius, ut mihi quidem ab initio propositum erat, præstitissem, & quidem in re tali, quod in Eclipsibus Lunaribus hucusque nondum adhuc suscepi.

Quibus vale, Benigne Astrophile, & fave porro qualibus qualibus nostris conatibus; præprimis mecum Venerare Deum *O. M.* ex toto pectore, quo Uranographiam nostram, jam sub Cœlo & Prælo ferventem, ac Prodromum Astronomiæ, totum meum novum Fixarum Catalogum exhibentem, Posteritatis bono, in lucem proferre, omniumque Astrosophorum Oculis ac Judicio, feliciter, proximo anno exponere non nequeam. Vale iterum iterumque. Dabam *Gedani*, Anno exeunte 1685.

Tabula *Observationum.*

Ordo Pha- sum	Tempus seu horolog. ex Altit. correct	Notanda:	Altitudines ○,) & Fixarum.	Per quas maculas transverſarū Umbrae Sectiones.
		Altitudo ○ Meridiana	12.39.0	
	Hor. "	Altitudo ○	1.54.0	
	3 19 0	Altitudo)	9. 0. 0	
	4 28 0	Altitudo Ca- pellæ	31. 0. 0	
	5 2 30	Altitudo Ca- pellæ	31. 2. 0	dub.
	5 8 0	Penumbra		
	9 32 25	Penumbra denſior		
	9 42 35	Penumbra denſiſſima		
	9 48 5	Initium quan- tum collige- re dabatur		
1	9 53 20	Palus Maræ- otis jam to- ta erat recta		Ad Montem Andum, & Paludem Ma- ræotidem
2	9 57 0			Per Montem Germanicianum, ad mare Syriticum, & Mont: Acabo.
3	10 0 15	M. Porphyri- tes nondum plane tectus erat		Ad Mont. Porphyritem, per mare Syr- ticum Montemque Ajacem.
4	10 3 5			Per Mont. Petri, inter Inf. Cercinnam, & Inf. Tarracinniam, per finum Syr- bonis, & Paludes Arabiæ.
5	10 6 25			Ad Inf. Ficariam, Maltam, M. Athos, per Mont. Pharan & Mont. Troicum.
6	10 10 25			Ad Sinum Apollinis, per Inf. Erroris, per M. Ætnam, Inf. Letoam & Didymam.
7	10 14 55	Infula Melos jam tota te- cta erat		Supra Sin. Apollinis, ad Lacum Hercu- leum, Inf. Siciliæ, per Mont. Parthe- nium & Taigetum, ad Inf. Melos & Mont. Lion.

Ordo Pha- sum	Tempus seu horolog. ex Altit. correct. H.	Notanda.	Altitudines ☉, ☿ & Fixarum	Per quas maculas transiverint Umbrae Sectiones.
8	10 19 55			Ad Inf. Minorcam, per Sinum Pastanum, M. Micalo, Inf. Cyprum, Mont. Hor. ad M. Sinai, & desertum Raphidim.
9	10 24 5			Ad M. Ligustinum, Panyæum, inter M. Sipylum & Didymum, per M. Liba- num & Seir.
10	10 27 10			Supra M. nigrum minorem, per M. A- penninum, Inf. Besbicam, M. Cimæ- um Montemque Calchaetan.
11	10 31 27			Ad montes, Serrorum, & Carphates, ad Byzantium, per M. Horminium, Tau- rum, & M. Delangueros.
12	10 36 0			Per montes Macrocecnios, Inf. Cya- neam, M. Amanum & Antitaurum.
13	10 41 20			Per Inf. Macram, per Erichtenios Sco- pulos, fin. Atheniensem, & Pal. Ar- cesam.
14	10 45 35			Per Lac. Hyperbor : superiorem, Pal. Byces, Inf. Acam, M. Herculis, fin. extremum Ponti. Montemque Para- pomifum.
15	10 48 40			Ad Lac. m Hyperbor : inferiorem, M. Immerium, per M. Coracem, Tau- can, fin : inferiorem Maris Caspii.
16	10 52 10			Per Montes Riphæos, Pal. Mæotidem. Insul. Majorem Caspii, & M. Nero sum.
10	56 35	Luna non- dum plenè obscurata		
10	58 25	Totalis Im- mersio.	0 1 "	
11	20 45	Altitudo Pro- cyonis	31 8 0	
11	25 45	Eadem Altitu- do	31 38 0	
11	36 0	Obscura illa		

Ordo Pha- sum	Tempus seu Horolog: ex Altit. correct.	Notanda.	Per quas Maculas transiverint Umbrae Sectiones.
		umbra vel nubecula plane in me- dietate Dis- ci Lunaris consistebat	
	Hor. 12 43 0	Initium E- merfionis seu Recuper. lu- minis	
17	12 46 40	Phases decref- centes, Palus Maræotis jam penitus tecta.	Ad mont. Andum, haud procul à Palu- de Maræotide.
18	12 51 0		Per Mare Eoum, Mare Syrticum, Mon- temque Casium.
19	12 57 0		Per montem Atlantem minorem, inter Insul. Cercinnam, & Insul. Taraciniam, per Mare Ægyptiacum, sinum Sirbo- nis, Montemque Pharan.
20	I 5 0 in ane		Ad Insul. Majorcam, Sardiniam, & Hie- ram, per M. Ætnam, Insul. Melos, ad Montem Annæ & Hajalon
		Initium Eclip- seos paul- lo supra Pa- ludem Ma- ræotidem extitit.	

Totalis Obscuratio, ad Montem Sanctum, infra Palu-
dem Mæotidem accidit.

Recuperatio Luminis fere ibidem contigit ubi initium
Coepit.

An An-

An Abstract of a Letter from Mr J. Flamsteed. Math. Reg. & F. of the R.S. giving the description & uses of an Instrument for finding the distances of Ψ^s Satellites from his Axis, with the help of the Table of Parallaxes and Catalogue of Eclipses; printed in the preceding Transactions. See Tab. 2. Fig. 2.

THE little Circle in the middle represents the *Planet Jupiter*, the four concentrick Circles the proper Orbits of his four *Satellites*, duly proportioned to the breadth of his body; the distances betwixt the *parallel* lines intersecting them, being each equall to one of his Semidiameters.

The 4 divided Circles next without these, are distinguished into so many parts as there are days and hours in each *Satellite* revolution; the Innermost of them serving for the first, or innermost *Satellit*; that next it, for the 2d, that next without this for the 3d, and the outermost for the 4th; above which is a small divided Arch of 15 degrees.

By this with the aforementioned tables to find the distances of the *Satellites* from Ψ^s *Axis* to a proposed time.

1. In the Table of Parallaxes of the Orb, find the the Parallax to the time proposed, and note whether it be to be *Added* or *Subtracted*.

2. Extend the thrid from the center of the Instrument over the *Parallax* numbred in the small Arch: it cuts off in the 4 divided Circles, so many hours as each *Satellit* spends in passing from the *Axis* of the shadow to the *Axis* of Ψ viewed from our Earth; these I call the *Simple Parallaxick Intervalls*, which if the *Parallax* was to be added, are also *additionall*, if to be Subtracted, *Subductive*.

3. To these *Parallaxick Intervalls* add the times of half the duration of the *Eclips* of each *Satellit*, which for the 1st. may be assumed 1^h. 10', for the 2^d. 1^h. 30".
greater

greater exactness being needless; but for the 3d, and 4th, when Eclipsed, (their Immerfions into the shadow and emerfion from it being commonly given in the Catalogue) take half the difference of these times at the next Eclipse to the time proposed, for the half duration, and add them to the *Simple Parallaſtick Intervalls*, ſo have you them *Augmented*. But note that this year 1686, and ſo often as the 4th *Satellit* is not Eclipsed, (which is two years in every fix) its Intervall needs no augmentation, the Catalogue ſhewing the very time when it paſſes the *Axis* of the ſhadow.

4. Find in the Catalogue the times of the Eclipses of each *Satellit* next preceding the time proposed, and when the 4th is not Eclipsed, of its paſſing the *Axis* of the ſhadow, to which, if the *Parallaſtick Intervalls* augmented were *Additionall*, add them to, if Subductive, *Subſtract them from*, each the time of its proper *Satellites* Eclipse, ſo have you very near the *Apparent times, when each Satellit laſt paſt over the Axis of φ* viewed from our Earth.

5. Subtract each of the times thus got from the time proposed: the Remainders are the *Intervalls of the Motion of each Satellit from φ 's Axis*.

6. Extend the thred from the Center over each of theſe Intervalls of Motion numbered ſeverally in the divided Circles belonging each to its proper *Satellit*, where it cuts the proper Orbit of that *Satellit*, whoſe intervall was numbered in its peculiar Circle, it ſhews amongſt the parallells, how many ſemidiameters of φ that *Satellit* is diſtant from him, and on which ſide of him tis poſited.

Note further, that the thred as it lay extended over the *parallax* of the *Orb* numbered in the ſmall Arch, where it cut the ſeveral proper Orbits of each *Satellit*, ſhew'd amongſt the Parallells, how many Semidiameters of φ the center of the ſhadow was diſtant from the center

of $\mathbb{Z}$ viewed from our Earth. And that if the Parallax of the Orb were additionall, the shadow lies on the right hand from $\mathbb{Z}$, if Subductive, on the left.

To explain these precepts, I shall give two brief examples. Let it be then proposed to know how far each Satellit appears distant from $\mathbb{Z}$ on the 26th of December this present year 1685, at 16^h. 52'. p. m. when the 3^d Satellit falls into the Shadow; also on July the 16. 1686. at 10^h. 00'. p. m. when there is no Eclipse.

Vide Tab. 2. Fig 3. 1685. Dec. 26^d. 16^h. 52'. p. m. the Parallax of the Orb is 9°. 20'. additional.

Therefore.	d	h	'	d	h	'	d	h	'	d	h	'
The simple Parallaſtick Intervalls Add	1.	05		2.	10		4.	25		10.	20	
The half duration of the Eclipses to be Added.	1.	10		1.	30		1.	18				
The Parallaſtick Intervalls Augmented	2.	15		3.	40		5.	43				
Laſt Immerſions and $\odot$ s in the Catalogue. Dec.	25.	09.	37.	25.	05.	47.	19.	12.	58.	10.	00.	30.
Times of laſt paſſing Jupiters Axis Dec.	25.	11.	52.	25.	09.	27.	19.	18.	41.	10.	10.	50.
Subtracted from the time propoſed. Dec.	26.	16.	52.	26.	16.	52.	26.	16.	52.	26.	16.	52.
Leaves the Intervalls of Motion. Over which numbered in their peculiar circles, the third being ſeverally layd, cuts the proper Orbit of each at their viſible diſtances from Jupiter.	1.	05.	00.	1.	07.	25	6.	22.	11.	16	06.	02.
	5	Semid		6 $\frac{1}{2}$	Sin ;		3.	dext.		4 $\frac{1}{2}$	dext.	

Vide Tab. 2. Fig. 4.

Again, 1686. July the 16. 10^h. p. m. the Parallax of the Orb. is 10°. 46. ſubductive.

Hence.	d	h	'	d	h	'	d	h	'	d	h	'
The ſimple Parallaſtick Intervalls ſub.	1.	12		2.	35		5.	10		12.	00.	
Half duration of the Eclipses add.	1.	10		1.	30							

The Par-

The Parallaxick Intervalls Augmented.	2. 22.	4. 05.		
The next last Emerfions and passing the Axis of the shadow July.	15. 05. 55.	15. 22. 02.	15. 09. 19.	15. 17. 52.
Time of last passing the visible Axis of Jupiter	15. 03. 33.	15. 17. 57.	15. 04. 09.	15. 05. 52.
The time proposed.	16. 10. 00.	16. 10. 00.	16. 10. 00.	16. 10. 00.
Intervals of Motion.	1. 06. 27.	0. 16. 03.	1. 0. 51.	1. 04. 08.
Therefore Distances from Jupiters Axis.	$5\frac{1}{2}$ Semid. $5\frac{1}{2}$ dext.	$8\frac{1}{2}$ Sinif.	$12\frac{1}{2}$ Sin.	$10\frac{1}{2}$ Sin.

And the Satellits stand at the two proposed times as in the two Figures.

In drawing of which, tho' I have considered their Latitudes from the line of their utmost Elongations passing through $\mathbb{Z}^s$ center, yet I give no rules for determining it, the contrivances and directions necessary on that account, being too many and troublesome to be inserted here: my design is only to shew the Ingenuous observer, how to find at what distance from $\mathbb{Z}$, each Satellit appears, that so he may not mistake one for another when he is to observe any of their Eclipses. But thus much I shall advise him, That from the beginning of the year 1686. for 3 years following, the Satellits, in the upper or remoter Semi-Circles of their Orbits from us, have South Latitude from the line of their utmost Elongations, passing over $\mathbb{Z}^s$ center; in the under or nearer North, but continually decreasing till the end of 3 years, when they change for the contrary. That the Latitude of the 4th Satellit is never more then $1\frac{1}{2}$ Semidiameter of $\mathbb{Z}$, of the 3^d little more then half as much, of the two innermost still less. And that towards the end of the year, the 4th Satellit (which will then have passed uneclipsed near two years,) will begin to fall into the *Penumbra* again, for which reason he may doe well to attend its transits at its first appearing, least perhaps it be really Eclipsed.

The Observatory, Novemb. 17. 1685.

V V V 2

A Re-

A Remarkable Account of a Liver, appearing Glandulous to the Eye ; communicated by M^r John Brown , Chirurgeon of S^t Thomas's Hospitall in Southwark ; in a Letter to one of the Secretarys of the Royal Society.

S I R,

I Send you here the figure of the *Liver* of an Hydro-pical Person , a Patient of our *Hospitall*, (as it was accurately taken by M^r *Faithorn*,) which I thought so curious as to be worthy the notice of the *Royal Society*, and therefore have presumed to communicate it to you.

The Person was about 25 years of age, a Soldier in one of his *Majesty's* Regiments here in Town ; who contracted his distemper by drinking much water, when he could not stirr from his duty, and catching cold at nights in being upon the guard : He was under the care of our Physicians for some time, by whose directions his swellings did by times abate ; but afterwards it was observed, that the method which had been beneficial to others, had not here the like success, his swellings returning upon him as before ; so that there was nothing more now to be thought of, but a *Paracentesis* ; which operation however we judged very hazardous, by reason of the time of the year ; and for that the Patient was very much emaciated ; yet he being so much swell'd, that it was uneasy to him to ly in his bed, he importun'd us very often, and with great earnestness, that the Operation might be performed. Whereupon we taking *Hippocrates* rule, *In casu ancipiti præstat Remedium anceps, quam nullum* ; and thinking it better to attempt a cure that might be but barely possible, then to abandon him to the certain expectation
of

of death; a *Paracenthesis* by the Physicians consent and directions, was made by me the fourteenth of *November* last past, whereby we drew from the Patient about 3 pints of Brinish Liquor, and within 4 days after as much more, the next day morning he dyes, and his death as was found upon dissection, was partly occasioned by a mortification upon his *Scrotum* and *Penis*.

This Operation was performed to the satisfaction of the Physicians and Chirurgeons that saw it, and by it the Patient had some ease for the present.

Upon opening the body, I believe I took out about 24 quarts of water; he had a large inflammation upon the *Peritonæum*; all his other inward parts not much disaffected, except the *Liver*; which now I am going to describe to you.

Its magnitude was not extraordinary, but rather seemed less than usuall, but that which was very remarkable (and I think the like case scarce ever observed by any *Author*;) and seems much to confirm the opinion of the Learned *Malpighius*, is this; It consisted in its concave, convex, and inward parts of *glands*, which (with the Vessells) made up the whole substance thereof; these *glands* contained a yellowish *Ichor*, like so many *Pustulæ*, and was I suppose part of the bilious humor lodged in the same, tho otherwise the *Liver* between the glands was of its usuall reddish colour. In the bladder of Gall, we found a soft friable stone, but otherwise nothing considerable further in that part. The *Liver* was opened before the Physicians of our *Hospital* Dr *Dawkins*, and Dr *Briggs*, as also Dr *Tyson*, and others who had the curiosity to see it; at which place Mr *Faithorn* was likewise, who then took that draught which I now present to you; so that this being attested by so good Judges, I need add no more but that this case by them all was thought worthy to

be presented to your excellent *Society*, which therefore at their request I have adventured to do, hoping you will favourably interpret this presumption of,

Sir,

December 15th.

Your faithfull Servant

1685. London.

J. BROWNE.

A Description of the cut of the Liver, &c.

Vid. Tab. 3. Fig. 1.

- A. A. A. { Describes the *Glands* in the concave part
of the lesser lobe of the *Liver*.
- B. B. B. { Describes the *Glands* in the concave part
of the greater lobe of the *Liver*; which
were of different magnitudes, tho in ge-
nerall they were much less in the lesser,
then in the greater.
- C. C. C. C. { Describes the inward part of the greater
lobe of the *Liver* as it was divided.
- D. D. D. D. D. { Are several black specks that appear'd in-
serted in those *Glands*, which were proba-
bly from the divarications of the Vessels,
being divided upon opening this lobe.
- E. { The *Vesicula Fellis*, which was of a green-
ish colour.
- F. { The *Vena Porta* tyed up with the *Ductus*
Biliarius, &c.
- G. { A particular sett of *Glands* lodged be-
tween the same and *Vena Cava*.
- H. *Vena Cava*.

I. Part of the *Ligamentum Suspensorium*.

I do not here present you with the convex part of the *Liver*, it being in every respect, the same with the concave part of both lobes as to its *Glands* here described.

Two Ex.

Two Extracts of the Journall of the Phil. Soc. of Oxford; one containing a Paper, communicated March 31, 1685, by the Reverend Dr Wallis, President of that Soc. concerning the strength of Memory when applied with due attention: the other, dated Dec. 15th, 1685, describing a large Stone Voided by way of Urine.

The first Extract.

UPON Occasion of a Discourse, at a meeting of the *Philosophical Society at Oxford* (March 24, 1684½,) concerning the Advantage which those may have (as to Memory and the Application thereof,) who want their Sight: Dr Wallis confirmed it by this consideration, That, even we, that have our Ey-sight, can yet with more advantage apply our Memory (in matters of intent consideration) by Night, in the Dark, when all things are Quiet; than by Day, when sights and Noises are apt to divert our Thoughts. And gave instance, in his own application of his Memory, by Night, (in performing Arithmetical Operations in great numbers;) better then, by Day, he could have done: and, even by Day, we may better do it with our Eys shut, than open.

And, because some present seemed to be surpris'd at the particulars mentioned; he did at their next meeting (Mar. 31. 1685) give this further account of it.

Having had the Curiosity, heretofore, to try, how far the strength of Memory would suffice me, to perform some Arithmetical Operations (as *Multiplication, Division, Extraction of Roots, &c.*) without the assistance of Pen and Ink, or ought equivalent thereunto: And finding it to succeed well (for instance) in Extracting
the

the Square *Root*, from Numbers of 8, 10, 12, or more places: I proceeded to try it (with success) in numbers of 20, 30, or 40 places. But was not curious to keep memorials of the particular numbers which I had so considered (as being but a Curiosity, and not of further use;) Till there happened on occasional Discourse of it with a Forraigner (*Johannes Georgius Pelshover, Regio-Montanus Borussus*) who coming to see the University, was pleased (as divers other Forraigners often do) to give me a visit; (*Febr. 18. 1670*;) at a time when I was afflicted with a tedious and severe Quartan Ague, (which held me, for a whole year, from about *Michaelmas* then last past, till about the same time in the year following:) which caused me to pass many nights with little or no sleep.

He was desirous I would tell him some of those numbers which I had so considered. Which, at the present, (for the reason but now mentioned) I could not do: save only that, on *Dec. 22. 1669*, I had (by night, in the dark,) extracted the Square *Root* of 3, (with Ciphers adjoined,) continued to the Twentieth place of Decimal Fractions: Finding it to be

1. 73205, 08075, 68877, 29353, *fere.*

Which is the Square *Root* of 3, with Forty ciphers adjoined;

3. 00000, 00000. 00000, 00000, 00000, 00000, 00000, 00000. (which I had chanced to write down, because $\sqrt{3}$ is a Surd which I might after have occasion to make use of) But added, that I could at pleasure perform the like at any time.

And when he further pressed me so to do: I did, that same night (by dark, in bed, without any other assistance than my Memory) propose to my self (at all adventures) this number, of 53 places.

2, 4681, 3579, 1012, 1411, 1315, 1618, 2017, 1921, 2224, 2628, 3023, 2527, 2931.

and

and found its Square Root (of 27 places) to be
157, 1030, 1687, 1482, 8058, 1715, 2171, *ferè*,
(Without any other Method of extracting *Roots*, than
what is commonly taught in Books of Arithmetick.)

These numbers, (having fixed them in my Memory,
by repeating the same Operation a night or two after,
) when he made me another visit, *March* the 11
following, I did dictate to him from my Memory,
(having not, before, committed them to writing) for
him to write down and examine: And did, afterwards,
write them down my self.

He did it seems, discourse this afterwards (at *London*)
with Mr *Oldenburg* (by whom he had before been directed
to me ;) to whom (as I remember) upon a Letter
from him, I gave a like account as now I do.

I will not undertake, that my Memory is now so
strong, as then it was, in my younger days : but do believe,
if occasion were, I could yet perform the like.
But I have never tryed it (in so great numbers) since
that time : Being by that time, sufficiently satisfyed,
that, a reasonable good Memory, fixt with good attention,
is capable of being charged, with more than a man
would at first imagine.

The Second Extract. Dec, 15th. 1685.

A Model, or pattern of a *Stone*, which came from
the Bladder of M^{rs}. *E. V. of Wallingford*, at the
age of 63 years, *Aug. 7. 1685*, was communicated to
the *Society*. The compass of it was $5\frac{1}{2}$ inches ; the length
 $4\frac{3}{4}$ inches, the weight 3 ounces *Avoird*. This *Stone* was
at its coming off, taken out by her Husband, without
the help or Instrument of *Physician* or *Chirurgion*,
and without effusion of Blood ; since its coming off,
she has been troubled with *Urinæ incontinentia*.

Part of a Letter to one of the Secr. of the R. Society, from the Learned Dr Salomon Reifselius, Chief Physician to the Duke of Wirtemberg; concerning the Siphon Wirtembergicus Stutgardix. 8. Oct. S. V. 1685.

STatim atque vestras 4 Junii datas vidit Serenissimus *Princeps* meus; in quibus communicas Vestra Experimenta in Siphone Vitreo decem pedum; scire desideras quantum temporis sit duraturus Siphonis fluxus nostri; das consilium pro extrahendis bullulis in Siphone collectis, quæ fluxum possint sufflaminare; speras Serenissimum *Ducem* passurum, ut & vobis & Orbi toti exponatur artificium Machinæ suæ: Jussit Typis manifestare secretam sui Siphonis structuram, inprimis postquam paulo ante rescivisset Socium aliquem vestrum ex mandato *Societatis Regiæ* imitatum esse eisdem effectus, & Phænomena sui Siphonis. Quod hisce jam Nundinis præteritis *Frankofurtensibus* factum esset, nisi prius voluissem in altitudinem & amplitudinem insignem & satis utilem elevare; quandoquidem à Vidua *Jordani* & alio Oculato Teste audivi, ipsum ad quinquaginta quatuor pedes in domo sua exaltasse cum fluxu & refluxu, cujus Vestigia ipse observavi, cum altitudinem metirer; quam vero altitudinem transcendere hactenus propter varia impedimenta & negotia nondum fuit concessum.

Ne vero diutius *Serenissimæ Societatis* desiderium frustrarer; aut morarer, fateor excellentissimi Dni. D^{ris}. *Papin* Siphonem ipsissimum esse *Wirtembergicum*, etiam cum recurvatione pedum factum; neque aliud esse mysterium ut Inventor ipse scripsit, in summitate, quam quod per infundibulum debeat impleri, sine qua impletionem non potest transfluere. Quod proxime Typis
amplius

amplius confirmabitur, quia longum nimis esset & tædiosum hic omnia scribere.

Ast ut in præsentī ostendam me hætenus nonnihil laborasse circa Siphonis effectus ; ecce inter Experimentandum, hoc quoque mihi occurrit ; ut didicerim, quomodo in Vertice vel ad latera possit effluere ; quod hætenus multi promissere, vix quisquam effecit ; sed quod Principi meo serenissimo ostendi, & promittere audeo ; me in quavis possibili Elevatione & transfluxu velle exhaurire aquam in Summitate vel ad latera, in posterum aperiam, quando per plura experimenta tam altitudinis quam continuationis certior redditus fuero.

Quid apud vos hætenus sit tentatum, & quousque sit progressus D^r. *Papin*, expecto à tua liberalitate : Interim per compendii modum vidi *Papiniani* Siphonis figuram & Descriptionem in mense Majo Novellarum Reip. Literariæ *Amsterdami* excusarum, cui gratulor de tam felici imitamine, &c.

A Full Description, with the Use, of the new Contrivance for Raising-Water, propounded in the Phil. Transl. N°. 173; by Dr Papin, Fellow of the R. S.

THere being already fix Months, since I did first propound a *new way for raising water*, printed since in the *Philosophical Transactions* of July 1685; and nobody having yet unriddled it, I believe it would be needless to conceal it any longer; but will rather, according to my promise, give a full description of the whole contrivance; that the R. S. may be pleased to improve it, and that it may be made use of, by those who may have occasion for it.

Tab. 1. Fig. 4. *AA* is the great Tumbler, that must have some little hole in the bottom as *I*.

ILL. a slender Pipe hidden by the Chimney-Board *BB*, whereby the Tumbler *AA* hath communication with the Pump or bellows *MM*.

MM. some kind of Pump or Bellows well shut, and having no other aperture, but through the Pipe *ILL*. These are put in some secret place, where a body may play the same and not be seen.

NN, a slender Pipe, that makes a communication between the glass *AA*, and the crown *FF*; this Pipe reacheth near to the cover of the crown, that the water contain'd in it, may not run down by that aperture.

EE the factitious Corall hollow within, shut at the bottom, and open at the top.

DDDD two crooked Pipes, soddered to the sides of the Corall *EE*, so that the water running down the Corall, may spout out through the holes *DD*.

OO a pipe hidden in the Corall *EE*, passing through the

the bottom of the same, where it must be well soldered, and reaching near to the bottom of the Rock *CC*.

PP a Pipe to convey the water from the glass *GG* into the Rock *CC*; this Pipe is well soldered to the cover of the sayd Rock.

Q a valve working by a spring at the bottom of the Pipe *PP*, to keep the water, that gets in that way, from returning back.

R another valve at the top of the Pipe *OO*, that the water, getting up that way, may not fall through the same.

Now it is plain, that the Rock *CC*, being fill'd partly with water, and partly with *Air*; if we open the bellows *MM*, the *Air* from the Crown *FF*, must run through the Pipe *NN*, into the Tumbler *AA*: and thence through the Pipe *ILL*, into *MM* to fill the vacuity made therein: the *Air* in the Crown *FF* being thus rarified, gives liberty to the *Air* in the Rock *CC* to rarify too, by driving the water through the Pipe *OO*: the water being got up into the Crown *FF*, runs down the Corall *EE*, and through the crooked Pipes *DDD* spouts out at their upper apertures, and from the shells *HH*, falls upon the Rock *CC*: if we come afterwards to shutt the Bellows *MM*, the *Air* got into their vacuity, must run back into the Tumblers *AA*, and press upon the water at the top of the Rock *CC*: but the *Air* in the sayd Rock, having been rarified, its spring is not sufficient to resist this pressure, and so the water is forced into the sayd Rock through the Pipe *PP*: and by thus opening and shutting the Bellows *MM*, the water must constantly circulate by the ways aforesayd.

As for the uses, this *way for raising water* may be apply'd to, this I do conceive: the glasses, being meerly to conceal the secret, must be left out; and there

may be made severall receptacles above one another to receive the rais'd water, so as doth the Crown FF: and there should be as many bellows to communicate every one with one receptacle: these bellows should be moved by an *Axis*, so that when the first is open, the second should be shut; the third open, the fourth shut; and so forth alternatively; which may be easily done: by this means, the first or lowest receptacle would give the necessary supply of water to the second, the second to the third, the third to the fourth, &c. till the water would be rais'd to the intended height: such receptacles might easily be set twelve or fifteen foot above one another, and so but few of them might raise water to a considerable heighth, as well as ordinary *Pumps* do; but this new way would have this advantage, that in the ordinary pumps the strength to be applyed lyeth near the water to be raised, but by this contrivance the stream of a River may be applyed to draw water out of a mine far distant from it: by the same way the stream of the *Thames* might keep constant water works in *Windsor-Castle*, as easie almost as in the lowest fields: the River *Seine* might do the same at *S^t. Germain*, and perhaps at *Verfailles* too, notwithstanding the great distance: for it is to be observed, that the Pipes of communication between the bellows and Engine, being meerly for the conveying of the *Air*, which moves very swiftly, they may be slender enough, and so contain but a small quantity of *Air* to be rarified; and besides they will not be subject to burst or leak, since the pressure they bear, being all external to the Pipe, will rather strengthen then break the same: from whence it follows, that the say'd Pipes need not be strong, but may be made at very small charges. It is also to be observed, that those bellows, that are open, have the *Air* in them very much rarified, so that the outward *Air* lyeth heavy upon (to shut) them,

them, by which means the motion of the Engine must be helpt in lifting up the opposite bellows, that are to be opened: and this observation may answer the greatest difficulty that might be objected against this contrivance; so that I don't question, but this way for raising water, may on severall occasions be of a great advantage.

As a farther Explication of the use of this contrivance, see Tab. 3. Fig. 2.

AB. AB. Are several Receptacles set above one another, which must be well shutt and stoppered every where.

CDD. CDD. Are two slender Pipes, whereby the first and third receptacles have a communication with the Pump *HH*.

EFF. EFF. Two other slender Pipes, whereby the second and fourth receptacles have a communication with the Pump *II*.

HH. II. Two Pumps whose plugs are so moved by the *Axis LL*, that when one goeth down the other goeth up.

MM. A wheel fastened to the *Axis LL*, that it may be moved by the Stream of a River.

NO. PQ. NO. PQ. Are big Pipes for the water to go up, from a lower into a higher receptacle.

O. Q. O. Q. Are Valves fitted to the top of the fore-said Pipes, that the water may not go down through the same.

Now it is plain that when the Plug in the Pump *HH* is going up, the *Air* comes in through the Pipes *CDD*, and so it is rarified in the first and third receptacles marked *AA*: and by that means the water may be driven up into the said receptacles through the Pipes *NO*. because at the same time the Plug in the Pump *II* going down, causeth the *Air* to return to its ordinary pressure in the second and fourth receptacles, that it may be able to drive up the water through the

the said Pipes *NO*, and the lowest Pipe draws the water that lyes open to the *Air*. By the same reason when the Plug in the Pump *II* goeth up, the *Air* must come in through the Pipes *EFF*: and so it is rarified in the second and fourth receptacles marked *BB*, and by that means the water may be driven up into the said Receptacles through the Pipes *PQ. PQ.* because at the same time the Plug in the Pump *HH* going down, causes the *Air* to return to its ordinary pressure in the first and third receptacles, so that it is able to drive up the water through the said Pipes *PQ.*

A Letter from Mr William Cole of Bristol, to the Phil. Society of Oxford; containing his Observations on the Purple Fish.

GENTLEMEN,

THere being many Naturall things, which I have formerly, and of late, happily found in the South and West parts of *England*, not (as I can find) published by any *Author*; besides many more, which have been discovered by the industrious exquisions of divers ingenious and curious Searchers of Nature; (as also others which were before thought to be *Exotiques*;) I have reason to believe, that there are very many more (for encouragement of such Inquirers) yet undiscovered in this our Native Country. Among others, that of the *Purple-Fish*, which I found the last Winter, on the *Sea Coasts*

Coasts of *Somerſet-ſhire*, and the ſhores of South-Wales oppoſite to it; and which alſo I doubt not but may be found on the other Coaſts of *England*, eſpecially the South and Western parts, (in which I am almoſt aſſured I have formerly ſeen them, though then unknown to me,) where there are Rocks and great Pebbles, and where the Tides run not too ſtrong. Which diſcovery I do not pretend to be ſo made by me, as having no hint of it before; for in *October*, 1684, there were two Ladies at *Mynehead*, (where I then was,) who (ſeeing what collections I had made of Natural things in thoſe parts,) told me, there was a certain perſon living by the Sea-ſide in ſome Port or Creek in *Ireland*, who made conſiderable gain, by marking with a delicate durable Crimſon Colour, fine Linnen of Ladies, Gent. &c. ſent from many parts of that *Iſland*, with their names, or otherwiſe as they pleaſed; which, they told me, (as they were informed,) was made by ſome liquid ſubſtance taken out of a *Shell-fiſh*; upon which, I ſhewed them all the Shells I had found on that Coaſt; one of them thought it to be taken out of a Limpot; the other out of that Shell here figured and deſcribed; but neither of them could inform me out of what part it was taken in either. After their departure from that Port, I made experiments on all the *Shell-Fiſhes*, in which I might probably think to find it; and brake them while the *Fiſhes* were alive in them, and with a ſhort pointed Pencill of Horſe hair (no other inſtrument being ſo convenient,) I tryed every part of each, which I imagined might yield the colour; but upon waſhing the Linnen (which I had marked) in ſcalding water, with ſope, there appeared nothing of any colour on them; upon which I was ready to give over any farther ſearch; but at length trying that part (in which I little thought the Tincture lay,) it immediatly turned to a light green; which being preſently dried and waſhed, as before, there appeared that delicate colour they told me of, as aforeſaid.

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The whole process, upon my oft repeated experiments, was as followeth.

These Shells, being harder then most of other kinds, are to be broken with a smart stroak of a hammer, on a plate of Iron, or firm piece of Timber, (with their mouths downwards) so as not to crush the body of the Fish within: the broken pieces being pickt off, there will appear a white Vein, lying transversely in a little furrow or cleft, next to the head of the Fish, which must be digg'd out with the stiff point of the Horse hair pencill, being made short and tapering; which must be so formed, by reason of the viscous clamminess of that white Liquor in the Vein, that so by its stiffness, it may drive in the matter into the fine Linnen, or white Silk; which (all though I have not yet tryed it) will (I think) be better then on Linnen, and make the colour appear more bright and vivid by its reflection.

The Letters, figures, or what else shall be made on the Linnen or Silk, (as much forced in, as it can be by the pencill,) will presently appear of a pleasant *light green colour*; and, if placed in the *Sun*, will change into the following colours; i. e. if in Winter, about noon, if in the Summer, an hour or two after Sun rising, and so much before setting, (for in the heat of the day, in Summer, the colours will come on so fast, that the succession of each colour, will scarce be distinguisht;) next to the first *light green*, it will appear of a *deep green*; and in few minutes change into a full *Sea-green*; after which, in a few minutes more, it will alter into a *Watchet blew*; from that, in a little time more, it will be of a *Purplish red*: after which, lying an hour or two, (supposing the *Sun* still shining) it will be of a very *deep Purple red*, beyond which the *Sun* can do no more.

{ Note, that these changes are made faster or slower,
 { according to the degrees of the *Suns* heat.
 But then the last and most beautifull colour, (after wash-
 ing

ing in scalding water and sope,) will (the matter being again put out into the *Sun* or wind to dry,) be much a differing colour from all those mention'd. i. e. of a fair bright *Crimson*, or neer to the *Prince's colour*; which afterwards (notwithstanding there is no use of any Stiptic to bind the colour) will continue the same, if well order'd; as I have found in handkerchers, that have been washt more then 40 times; only it will be somewhat allay'd, from what it was, after the first washing. I made large Letters on so many cloths, as there are distinct colours, to put them into a Book, which kept them from the *Air*; I have severall months after, shewed the various colours distinct as aforesaid; yet by often opening the Book, and so exposing them to the *Air*, all the colours, excepting the two last, (I mean before washing either) will fade; but all the colours, being washt, will be one and the same. While the Cloth so writ upon, lyes in the *Sun*, it will yield a very strong fetid smell; (which divers who have smelt it could not endure,) as if *Garlick & Assa-fætida* were mixt together: which I proved but few days before I wrote this, though it had been at least twelve months, kept in a Book, and before it was laid in the *Sun*, had very little of that smell. I have farther observ'd, that the cloth dyed and washt, soon after it is wrote on, will appear fresher & brighter, then after being long kept in a Book; as I found by some I newly caused to be washt, after they had been 14 months so kept.

The Shells are of divers colours, but the most part of them white; some are red, when newly taken off the Rocks; some yellow; others of both those colours; some a blackish brown; many of a Sandie colour; and some few striped with white and brown parallell lines: I have herewith sent you most of the colours, with one of the largest I have found, and one of the least; with severall of the middle sized.

The first Linnen Cloths marked with Letters and Names, I sent to Dr Plot in Nov. 1684, being then one of the *Secretaries* to the *Royal Society*, in *London*, to whom he communicating my Letter, containing my first observations, and also shewing the Linnen so marked (at the same time,) advised me that it was so acceptable to them, that they were pleased to order him to return me their thanks; and that they had appointed some Gent. to wait on his late *Majesty* with them; who (with divers Persons of Honour to whom they were shewn) was much pleased with the sight, and relation of the discovery, as new unto him. After which I was desired to send up some of the Shells with the Fishes alive in them; which could not be done any other way, then by sending them in some Ship bound for *London*, in an open Earthen Pan; renewing the *Sea-water* every day: after which manner I have kept them near a fortnight, & longer I might, had I not made use of them; for it seems to be a kind of *Amphibious Animal*, alternately living in both Elements every Tide: being out of their native place, and in want of such Vicissitudes, they take this course to find the *Air*; when any of them are put into a Vessel of *Sea-water*, (for in fresh they soon expire,) after they have lain some time on the bottom of the Vessel, they creep up to the superficies of the water, and by extending a kind of Lipp, with their operculums, cling to the side of the Vessel or Pan, (which is most convenient for their ascent,) with about half that part above the water, sometimes creeping down under it, and, returning again to their station, between Wind and Water. This I designed to accomplish, and was contriving this way to gratify their desires; to the end his *Majesty* the great *Patron* and *Founder* of their *Society*, might have the pleasing diversion of seeing the experiment made in his *Royall* presence; but a stop was put to this design by a Calamity too great and public to be mention'd.

There

There are other imperfect observations, which I have made of this our *Purple-Fish*; which I may in some time give you a better account of, *viz.* 1 At what age of the Moon, and time of the Tides (i. e. Spring or Neap,) their Veins are fullest, and give the best Tincture? for I have found a difference, they being sometimes fuller and whiter, and the juice more viscid, at other times more flaccid and watery.

2 Whether they are in greater perfection in Summer or Winter? having not, as I expected received any of them this last Summer, to make that experiment, by reason of our Western troubles in the late Rebellion. Such as are inclined to these Inquiries, and have more liberty from business than I have, may make farther improvements of this thing, in the preparations of it by Urine, Salt, &c. mentioned by *Pliny* and other *Authors*. And although the Shells are small, yet their abundance on our Coasts, may yield matter enough, (with the more pains) to dy a quantity of fine Wooll, or Silk, so as to render the discovery some way usefull, and to answer the vulgar objection of *cui bono*, made by such persons, who own no good but what relates to the Body. I am of opinion there may be found on our marine Coasts, some bigger Shells, which may have a colouring juice, though not the same with this, for that I know few Naturall things both of Animals and Vegetables, but what have divers sorts of the same kind in the same place. This may be a sufficient intimation to all Ingenious persons, living near the *Sea*, to imploy some time to find this out.

My purpose was, with this discourse to have drawn and sent you figures of these Shells, with the Fish pulled out and extended beyond the Vein, together with their Operculum; to which end I sent lately for some of them, but they being not yet come (to satisfy the desires of some Gent. of the *Society*) I have sent it now, (in that particular,) Y y y 3

particular,) not so perfect as I could wish. As for the qualities of this Fish, I can say but little, only I was assured by some who had boyled, drest, and eaten of them, that they are wholesome food; as good at least, and tast as well, as Lympots or Winkles, only the flesh something harder.

For what use nature hath designed this Vein of colouring juice, unto the *Animal*, will be difficult to find out; perhaps it may be the spermatic and prolifick matter, by which they propagate their kind; which I am inclinable to think, from its consistence, virulent and fætid savor. A Microscope (which I had not then with me) might have given some light in this matter, and confirmed it, if those *Animalcula* are to be found in it, which are in the Masculine Sperm of Fish, and other living Creatures, (as some affirm, from the many late experiments they have made.) Or else it may be a humour in this *Animal*, which by its Vitall energie, as the spring of life and motion, supplies the want of heart, liver, blood, &c. as in other exsanguineous *Animals*. Those who shall seek after them may find, as I have done, some of those *Purple Shells*, in which are the *Cancelli*, or rather *Astaci*, unto which they are more like, and so may mistake; for those little Crabbs or Crawfishes, I have found in most of our *English Shells*, excepting the bivalved, and *Patella's*; of which in many parts, (especially in the *West-Indies*,) there are many sorts, and some very large; which our Country-men there call the *Soldiers*; for that, they say, they enter by force, kill, and take possession of those houses they have not built; and when they grow too big, forsake them, and enter into larger: whether that be true, I know not; This I have found, when I have broken some of the Shells in which those vagrants are, so as not to bruise their bodies, and then put them naked into the water, I have beheld them with nimble springing motion, to run to and fro till they find

find a stone to hide themselves under; which not finding, they bury themselves in the loose sand : and this observation gave me full satisfaction, that they were not (at least all the kinds,) connate & coalescent with their Shells, as other testaceous *Animals* of the *Sea* and *Land* are; but this being besides my purpose, I return to the *Purpura*.

There is no doubt, but that it is a species of that kind ; of which there are many sorts, differing in bigness, structure, colour of the Shell, according to the nature of the *Sea* grounds, depth or shallowness of Water, Rocks, Gravell, Mud, as also the Latitude where they are found ; and so differing also in the varieties of colours of the tinging juice in their Veins, as black, livid, violaceous, deep Sea-green, light and deep red, Amethystine, &c. but the best of all were found in the *Tyrian Seas*, near that *Island*, on which the renowned City of *Tyre* was built, (now an inconsiderable Town called *Sur* ;) this was celebrated, and prized above all the rest, for that it excelled them all in its illustrious colour, called in former Ages by divers names, as *Ostrum Sarranum*, *Pelagium*, *Venenum Tyrium*, *Purpurissum*, *Flores Tyriani*, &c. Almost all *Authors* agree, that it lyes in a certain Vein in the Fish, and some of them mention it to be white & viscous, as this of ours is. It were to little purpose, to give the History at large of all the *Purpuræ* ; and when and how first discovered by *Phœnix* the Son of *Agenor*, 2^d King of the *Phœnicians*, by means of a Shepherds Dog devouring one of the Fishes, and colouring one of his lips with that excellent dye : by which its Antiquity appears. In succeeding Ages it received improvements, to the time of *Pliny*, in whose days (being in the reign of the *Vespasians*,) it seems to have arrived at its highest perfection ; of which he hath made more particular observations than I can find in other *Authors* ; for which he had great opportunity living in the Imperial City

City of the World, where the Artists in preparations of that tinging *Succus*, for dying the Robes and other Vestments of Emperors, Senators, &c. strove to excell each other in new fashioned Purples for their own gain, and to gratify the luxuriant excesses of the Great ones of those times, by preparing and mixing the colour (found in the severall sorts of Shells as aforesaid.) This colour sold then at great prices; that which was the fine double dyed Purple of *Tyre*, called *Diabapha*, yielded 1000 *Roman Denarii* the pound, which is computed to be more then 30*l* Sterling; and this of ours being so excellent a colour, without other preparation or addition of any thing to it, may now or at least hereafter by (farther improvement) vye with the *Tyrian Purple*. *Johnston* out of *Aristotle*, mentions a species of these *Fishes* under the name, of *Littorales quæ parvæ, & flore sunt rubro*; this agrees with ours, which may be named *Purpura littoralis* (five *Tenientis*) *parva turbinata*.

Since the importunity of some friends hath hastned this discourse sooner then I intended, (and so prevented those farther experiments, which I might have made this next Summer;) presuming on your favourable acceptance, and excusing of the imperfections of it, which could not be so well digested (in the Method of it) as it might have been, were I not engaged in publique employment, which requires my dayly attendance; I have therefore now presented you with it as it is: And if I find it gratefull to you, & to such others, as shall happen to read it, I shall be encouraged to impart other things, which I esteem no less considerable then this; to the end that the stupendious works of nature, or rather of the God of nature, (in which are clearly seen his infinite wisdom power and goodness,) may by us, as his Instruments, be celebrated for his glory: In whose service I am one of the least of your *Society*

WILLIAM COLE.

Tab. 3. Fig. 3, 4, 5, 6, 7, *Several Shells of the Purpura, in their Natural bigness*. Fig. 8. the *Operculum*. *A Letter*

A Letter from Mr William Nicolson, to the Reverend Mr Walker, Master of University Coll: in Oxford; concerning a Runic Inscription at Beaucastle.

TIS now high time to make good my promise of giving you a more perfect Account of our two *Runic* Inscriptions at *Beau-Castle* and *Bridekirk*. The former is fallen into such an untoward part of our Country, and so far out of the common Road, that I could not much sooner have either an opportunity, or the Courage to look after it. I was assur'd by the Curate of the place, (a Person of good sense & Learning in greater matters,) that the Characters were so miserably worn out since the Lord *William Howards* time, (by whom they were communicated to *S^r H. Spelman*, & mentioned by *Wormius*, *Mon. Dan.* p. 161,) that they were now wholly defaced, and nothing to be met with worth my while. The former part of this Relation I found to be true: for (tho' it appears that the forementioned Inscription has bin much larger then *Wormius* has given it, yet) 'tis at present so far lost, that, in six or seven lines, none of the Characters are fairly discernable, save only *ᚠ ᚦ ᚠ ᚱ ᚱ*; and these too are incoherent, and at great distance from each other. However, this *Epistilium Crucis* (as *S^r H. Spelman*, in his Letter to *Wormius*, has called it,) is to this day a noble Monument; and highly merits the View of a Curious Antiquary. The best account, *S^r*, I am able to give you of it, be pleased to take as follows.

'Tis one entire Free-Stone of about five yards in height, washed over (as the Font at *Bridekirk*,) with a white oyley Cement, to preserve it the better from the injuries

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of time and weather. The figure of it inclines to a square Pyramid; each side whereof is near two foot broad at the bottom, but upwards more tapering. On the West side of the Stone, we have three fair Draughts, which evidently enough manifest the Monument to be Christian. The Lowest of these represents the Pourtraiture of a Layman; with an Hawk, or Eagle, perch'd on his Arm. Over his head are the forementioned ruines of the Lord *Howard's* Inscription. Next to these, the Picture of some Apostle, Saint, or other Holy man, in a sacerdotal Habit, with a Glory round his Head. On the top stands the Effigies of the B. V. with the Babe in her Arms; and both their Heads encircled with Glories as before.

On the North we have a great deal of Checquer-work; subscribed with the following Characters, fairly legible.

|| ᚠᚢ ᚠ ᚠ ᚠ ᚢᚱᚢ ᚠ ||

Upon the first sight of these Letters, I greedily ventured to read them *Rynburu*: and was wonderfully pleased to fancy, that this word thus singly written, must necessarily betoken the final extirpation and *Burial* of the Magical *Runæ* in these parts, reasonably hoped for, upon the Conversion of the *Danes* to the Christian Faith. For, that the *Danes* were antiently, as well as some of the *Laplanders* at present, gross Idolaters and Sorcerers, is beyond Controversy; and I could not but remember, that all our Historians tell us, that they brought their Paganism along with them into this Kingdome. And therefore 'twas not very difficult to imagine that they might for some time practise their *Hocus* tricks here in the North, where they were most numerous and least disturbed. This conceit was the more heightened, by reflecting upon the natural superstition of our Borderers at this day; who are much better acquainted with, and do
more

more firmly believe, their old Legendary stories of *Fayries* and *Witches*, then the Articles of their Creed. And to convince me yet further that they are not utter strangers to the *Black Arts* of their forefathers, I accidentally met with a Gentleman in the neighbourhood, who shewed me a Book of Spells and Magical Receipts, taken (two or three days before) in the pocket of one of our *Moss-Troopers*: wherein, among many other conjuring Feats, was prescribed a certain Remedy for an Ague, by applying a few barbarous Characters to the Body of the party distempered. These, methought, were very near akin to *Wormius's* R A M R U N E R; which, he says, differed wholly in figure and shape from the common *Runæ*. For, though he tells us, that these *Ramruner* were so called, *Eo quod Molestias, dolores, morbosque hisce infligere inimicis soliti sint Magi*; yet his great friend *Arug: Jonas*, more to our purpose, says *that--His etiam usi sunt ad benefaciendum, juvandum, Medicandum tam animi quam Corporis morbis; atque ad ipsos Cacodæmones pellendos & fugandos*. I shall not trouble you with a draught of this Spell; because I have not yet had an opportunity of learning, whether it may not be an ordinary one, and to be met with (among others of the same nature) in *Paracelsus* or *Cornelius Agrippa*.

If this conjecture be not allowable; I have, S^r, one more which (it may be) you will think more plausible than the former. For if, instead of making the third and fourth Letters to be two K K. И И. we should suppose them to be T. T. E. E. the word will then be *Ryeeburu*; which I take to signify, in the old *Danish* Language, *Cæmeterium*, or *Cadaverum Sepulchrum*. For, tho the true old *Runic* word for *Cadaver* be usually written R A T *Hrae*; yet the *H* may, without any violence to the Orthography of that tongue, be omitted at pleasure; and then the difference of spelling the word, here at *Beaucaastle*, and on some of the ragged Monuments in *Denmark*, will not

be great. And for the countenancing of this latter Reading, I think the above mentioned *Checquer work* may be very available : since in that we have a notable Emblem of the *Tumuli*, or burying places of the Antients. (Not to mention the early custome of erecting Crosses and Crucifixes in Church-yards: which perhaps, being well weighed, might prove another encouragement to this second Reading.) I know the Checquer to be the Arms of the *Vaux's*, or *De Vallibus*, the old Proprietours of this part of the North; but that, I presume, will make nothing for our turn. Because this & the other carved work on the Cross, must of necessity be allow'd, to bear a more antient date then any of the Remains of that Name and Family; which cannot be run up higher then the Conquest.

On the East we have nothing but a few Flourishes, Draughts of Birds, Grapes and other Fruits: all which I take to be no more then the Statuary's Fancy.

On the South, Flourishes and conceits, as before, and towards the bottom, the following decay'd Inscription.

||✠. DB : : ✠RMT: ||

The Defects in this short piece are sufficient to discourage me from attempting to expound it. But (possibly) it may be read thus.

Gag Ubbo Erlat, i. e.

Latrones Ubbo Vicit.

I confess this has no Affinity (at least, being thus interpreted) with the foregoing Inscription: but may well enough suit with the manners of both antient and modern Inhabitants of this Town and Country.

Upon your pardon and Correction, S^r, of the Imperinencies and Mistakes in this, which I shall humbly hope
for)

for,) I shall trouble you with my further observations on the Font at *Bridekirk*; and to all your other Commands shall pay that ready obedience which becomes,

Carlile,

Nov. 2.

1685.

S^r,

Your most obliged and

Faithfull Servant

WILL. NICOLSON.

*A Letter from Mr Nicolson to S^r W^m. Dugdale ;
concerning a Runic Inscription on the Font at
Bridekirk.*

Hon^d. S^r,

Carlile; Nov. 23, 1685.

MY Worthy and good Lord, our Bishop, was lately pleased to acquaint me, that you were desirous to have my thoughts of the Inscription on the Font at *Bridekirk* in this County. I am, S^r, extremely conscious of the rashness of bringing any thing of mine to the view of so discerning an Antiquary; but, withal, very tender of disobeying so great and worthy a Person. I know you were pleased to make your own observations upon it, in your Visitation of these parts, when *Norroy*: and I shall hope that you will give me an opportunity of rectifying, by yours, my following conjectures.

1. The Fabrick of this Monument does, I think, fairly enough evince that 'tis Christian; and that it is now used to the same purpose for which it 'twas at first designed. Mr *Cambden* (tho' not acquainted with the Characters of the Inscription, yet) seems to fancy thus much: and, for

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proof of his opinion, brings a notable Quotation out of S^t *Paulinus's* Epistles. But he needed not to have sent us so far off for a Voucher; if he had taken good notice of the Imagery on the East side of this stone; as I doubt not, S^r, but you have done. We have there, fairly represented, a person in a long Sacerdotal Habit dipping a Child into the water; and a Dove (the Embleme, no doubt, of the *H. Ghost*,) hovering over the Infant. Now, S^r, I need not acquaint you, that the Sacrament of Baptism was antiently administered by plunging into the water, in the Western as well as Eastern parts of the Church; and that the *Gothic* word *ΔΑΠΝΩΝ* (*Mar*, 1. 8. And *Luc*. 3. 7. and 12.) the *German* word *taufen*, the *Danish* *Døbe*, and the *Belgic* *doopen*, doe as clearly make out that practise, as the *Greek* word *βαπτίζω*: Nor, that they may all seem to be deriv'd from [*βαπτεν*] another word of the same Language and signification; and are evidently akin to our *English* *Dip*, *Deep*, and *Depth*. Indeed our *Saxon* Ancestors expressed the Action of Baptism by a word of a different Import from the rest. For, in the forementioned place of S^t *Mark's* Gospell, their Translation has the Text thus: *lceop pullige on pætere. he eop pullað on halgum gæpte* 7 i. e. *Ego vos aquis Baptizo; ille vos Spiritu Sancto Baptizabit*. Where the word *pullian* or *pulligean* signifies only simply *Lavare*: whence the *Latin* word *Fullo*, and our *Fuller* have their Original. But from hence to conclude that the *Saxons* did not use dipping in the Sacrament of Baptism, is somewhat too harsh an Argument.

2. There are other Draughts on the North and West side of the Font, which may very probably make for our purpose: but with these (as not thoroughly understanding them, and having not had an opportunity of getting them drawn in paper) I shall not trouble you at present.

3. On the South side of the stone we have the Inscription; which I have taken care accurately to write out. And 'tis as follows :

†R	·	W	A	R	†	·	*	†	·	‡	·	I	P	R	†	‡	·	7	·	†	‡	·
‡	†	·	‡	†	·	R	Ð	·	‡	I	R	·	†	R	·	‡	·	B	R	†	‡	·

Now, these kind of Characters are well enough known, (since *Ol. Wormius's* great Industry in making us acquainted with the *Literatura Runica*), to have bin chiefly used by the *Pagan* Inhabitants of *Denmark*, *Sweden*, and the other Northern Kingdomes; and the *Danes* are said to have swarmed mostly in these parts of our *Island*. Which two considerations seem weighty enough to persuade any man, at first sight, to conclude that the Font is a *Danish* Monument. But then on the other hand, we are sufficiently assured, that the Heathen *Saxons* did also make use of these *Runæ*; as is plainly evident from the frequent mention of *Runcþæptigen* and *Runrtapar* in many of the Monuments of that Nation, both in Print and Manuscript still to be met with. Besides, we must not forget that both *Danes* and *Saxons* are indebted to this Kingdom for this Christianity: and therefore thus far, their pretensions to a *Runic* (Christian) Monument may be thought equal. Indeed some of the Letters (as Ð, 3 and 7) seem purely *Saxon*; being not to be met with among *Wormius's* many Alphabets: and the words themselves (if I mistake them not) come nearer to the Antient *Saxon* Dialect, than the *Danish*. However, let the Inscription speak for it self: and I question not but 'twill convince any competent and judicious Reader that 'tis *Danish*. Thus therefore I have ventured to read and explain it:

Er Ekard han men egroeten. and to dis men red wer Taner men brogten. i. e.

Here *Ekard* was converted; and to this Mans Example were the *Danes* brought.

There

There are only two things in the Inscription (thus Interpreted) that will need an Explanation.

1. Who this *E kard* was? And this is indeed a Question of that Difficulty, that I confess, I am not able exactly to answer it. The proper name it self is ordinary enough in the Northern Histories; though Variously written: As, *Echardus*, *Echinardus*, *Eginardus*, *Ecardus*, and *Eckhardus*. 'Tis certainly a name of Valour, as all others of the like Termination; such as, *Bernhard*, *Everhard*, *Gothard*, *Reinhard*, &c. So that, it may well become a General, or other great officer in the *Danish* Army: and such we have just reason to believe him to have been, who is here drawn into an example for the rest of his Countreymen. Our Historians are not very particular in their accounts of the several IncurSIONS and Victories of the *Danes*; and their own writers much more imperfect: and therefore, in cases of this nature, we must content our selves with probable conjectures.

2. *Han men egrosten*; which, rendered *Verbatim*, is *Have men turn'd*, i. e. was turn'd. A phrase, to this day, very familiar in most dialects of the antient *Celtic* tongue; though lost in our *English*. In the *High-Dutch* 'tis especially obvious; as, *Man Saget*, *Man hat gesagt*, *Man lobet*, &c. And the *French* Impersonals (*On dit*, *On fait*, &c.) are of the same strain; and evident Arguments that the *Teutonic* and *Gaulish* Tongues were antiently near akin.

The Characters † ‡ and § are manifest Abbreviations of several Letters into one: of which sort we have great variety of examples in several of *Wormius's* Books: And such I take the Letter Ð to be, instead of † and ‡; and not the *Saxon* Ð. I must believe ¶ to be borrowed from the *Saxons*: and § I take to be a corruption of their ¶ or W. The rest has little of Difficulty in it. Only the Language of the whole seems a mixture of
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the *Danish* and *Saxon* tongues: but that can be no other then the natural effect of the two Nations being jumbled together in this part of the World. Our Borderers, to this day, speak a Leash of Languages (*Brittish*, *Saxon*, and *Danish*) in one; and 'tis hard to determine, which of those three nations has the greatest share in the Mottly Breed.

S^r,

Your, &c. W. N.

An account of the Latitude of Constantinople, and Rhodes, Written by the Learned M^r John Greaves, sometime Professor of Astronomy in the University of Oxford, and directed to the most Reverend James Usher, Arch-Bishop of Armagh.

UPON Intimation of your *Grace's* desires, and upon importunity of some Learned Men, having finished a Table, as a key to your *Grace's* exquisite disquisition, touching *Asia* properly so called; I thought my self obliged to give both you and them a reason, why in the situation of *Byzantium*, and the *Island Rhodus*, (which two eminent places I have made the *ωδανύματα* and bounds of the Chart,) I dissent from the traditions of the Antients, and from the Tables of our late and best Geographers, and consequently dissenting in these, have been necessitated to alter the Latitudes, if not Longitudes, of most of the remarkable City's of this discourse. And first for *Byzantium*, the received Latitude

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of it by *Appianus*, *Mercator*, *Ortelius*, *Maginnus*, and some others, is 43 degrees and 5 minutes. And this also we find in the *Basil* Edition of *Ptolemy's* Geography, procured by *Erasmus* out of a Greek MS. of *Pettichius*. The same likewise is confirmed by another choice MS. in Greek, of the most learned and judicious M^r *Selden*, to whom for this favour and several others I stand obliged. And as much is expressed in the late Edition of *Ptolemy* by *Bertius*, compared and corrected by *Sylburgius*, with a Manuscript out of the Palatine Library. Wherefore it cannot be doubted, having such a cloud of witnesses, but that *Ptolemy* assigned to *Byzantium*, as our best modern Geographers have done, the Latitude of 43°. 5'. And this will farther appear, not only out of his Geography, where it is often expressed, but also out of his *μεγάλη συντάξις* or *Almagest*, as the *Arabians* term it, where describing the Parallel passing διὰ Βυζαντίου, he assigns to it 43°. 5'. What was the opinion concerning *Byzantium* of *Strabo* preceding *Ptolemy*, or of *Hipparchus* preceding *Strabo*, or of *Eratosthenes* antienter, and it may be accurater then all of them, (for *Strabo*, (Lib. 2.) calls him *τελευταῖον παραμαρτυρούμενον πρὸς γεωγραφίας*) though *Tully* (Lib. Ep. ad *Att.*) makes *Hipparchus* often reprehended *Eratosthenes*, as *Ptolemy* after him doth *Marinus*, their writings not being now extant, (unless those of *Strabo*,) cannot be determined by us. But as for *Strabo*, in our inquiry, we can expect little satisfaction; for his description of places, having more of the Historian, and Philosopher, (both which he hath performed with singular gravity and judgement,) than the exactness of a Mathematician, who strictly respects the Position of places, without inquisition after their nature, qualities, and Inhabitants; (though the best Geography, would be a mixture of them all, as *Abulfeda*, an *Arabian* Prince in his *Rectification of Countries* above Three Hundred years since hath done,) I say

say for these reasons, we can expect little satisfaction from *Strabo*, and less may we hope for from *Dionysius Afer*, *Arrianus*, *Stephanus Byzantinus*, & others. Wherefore next having recourse to the *Arabians*, who in Geography deserve the second place after the *Græcians*, I find in *Nassir Eddin* the Latitude of *Byzantium*, which he terms *Buzantiya*, and *Constantiniya*, to be 45 degrees, and in *Ulug Begs* Astronomical Tables the same to be expressed. *Abulfeda* chiefly follows four Principall Authors as his Guides, in the compiling of his Geographical Tables, those are, *Alfaras*, *Albiruny*, *Hon Saïid Almagraby*, lastly *Ptolemy*, whose Geography he terms a description of the *Quadrant*, (or the fourth part of the Earth) inhabited; and all these, according to his assertion, place *Byzantium* in 45 degrees of Latitude. And here it may justly be wondered, how this difference should arise between the Greek Copies of *Ptolemy*, and those translated into *Arabick* by the command of *Almamon*, the Learned Calife of *Babylon*; for *Abulfeda* expressly relates, that *Ptolemy* was first interpreted in his time, that is, in the computation of *Almecinus* in *Erpenius's* Edition, and of *Emir Cond* a *Persian* Historiographer, more then 800 years since: Concerning which *Abulfeda*, writes thus, *This Book* (discourfing of *Ptolemy's* Geography) *was translated out of the Græcian Language into the Arabick, for Almamon*: And in this I find (by three fair MSS of *Abulfeda*) *Byzantium* to be constantly placed in 45°. and as constantly in the Greek Copies in 43°. 5'. But in the *πρόχειροι ναύτιες* of *Chrysococca*, out of the *Persian* tables, (made about the year 1346 in *Scaliger's* Calculation,) it is placed in 45°. To reconcile the difference between the *Greeks* and *Arabians* may seem impossible, for the common refuge of flying to the corruption of numbers by Transcribers, and laying the fault on them, which sometimes is the *Authors*, will not help us in this particular; seeing the *Greek* Copies a-

gree amongst themselves, and the *Arabick* Copies amongst themselves. The best way to end the dispute, will be, to give credit concerning the Latitude of *Byzantium*, neither to the *Greeks*, nor *Arabians*. And that I have reason for this assertion, appears by several observations of mine at *Constantinople*, with a brass Sextant of above 4 foot Radius. Where taking, in the Summer Solstice, the Meridian Altitude of the Sun, without using any *παραφάσεις*, for the Parallax, and refraction, (which at that time was not necessary,) I found the Latitude to be 41 degrees 6 minutes. And in this Latitude in the Chart I have placed *Byzantium*, and not in that either of the *Greeks*, or *Arabians*. From which observation, being of singular use in the Rectification of Geography, it will follow by way of Corollary, That all Maps for the North East of *Europe*, and of *Asia*, adjoining upon the *Bosphorus Thracius*, the *Pontus Euxinus*, and much farther, are to be corrected; and consequently the situation of most Cities in *Asia* properly so called, are to be brought more Southerly then those of *Ptolemy*, by almost two intire degrees, and then those of the *Arabians*, by almost four.

Concerning *Rhodes*, it may be presumed, that, having been the Mother, and Nurse of so many Eminent Mathematicians, and having long flourished in Navigation, by the direction of these, and by the vicinity of the *Phœnicians*, they could not be ignorant of the precise Latitude of their Country, and that from them *Ptolemy* might receive a true information. Though it cannot be denied, but that *Ptolemy* in places remoter from *Alexandria*, hath much erred. I shall only instance in our own Country, where he situates *Λονδίνιον*, that is *London*, in 54 degrees of Latitude; and the *μέσον* or the middle of the *Isle of Wight*, (which in the printed Copies is falsely termed *ἑκκλησις*, but in the MSS. rightly *ἑκκλῆς*;) in 52 degrees and 20 minutes of Latitude.

tude. Whereas *London* is certainly known to have for the Altitude of the Pole, or Latitude of the place, only 51 degrees and 32' minutes: and the middle of the *Isle of Wight* not to exceed 50 degrees and some minutes.

But in my judgement *Ptolemy* is very excusable in these and the like errors, of several other places far distant from *Alexandria*; seeing he must for their position necessarily have depended either upon relations of Travellers, or observations of Mariners, or upon the Longitude of the day, measured in those times by *Clepsydræ*: all which how uncertain they are, and subject unto error, if some Celestiall observations be not joyned with them, and those exactly taken with large Instruments, (in which kind the Ancients have not many, and our times, (excepting *Tycho Brahe*, and some of the *Arabians*) but a few,) I say no man, that hath conversed with modern travellers, and Navigators, can be ignorant. Wherefore to excuse these errors of his (or rather of others fathered by him) with a greater absurdity, by asserting the Poles of the World since his time to have changed their site, and consequently all Countries their Latitudes, as *Mariana* the Master of *Copernicus*, and others after him have imagined: or else to charge *Ptolemy*, being so excellent an Artist, with ignorance, and that even of his own Country, as *Cluverius* hath done, (from which my observations at *Alexandria*, and *Memphis*, may vindicate him,) the former were too great a stupidity, and the latter too great a presumption. But to return to *Rhodes*: an Island (in *Eustathius*'s comment upon *Dionysius*'s *ᾠδή-μους*) of 920 furlongs circuit, where according to *Ptolemy* the Parallel passing *διὰ ῥόδου*, hath 36 degrees of Latitude, and so hath *Lindus*, and *Ἰηλυσσός* the chief Cities of the Island; the same is confirmed by the MS. but where the printed Copy, and *Eustathius* read *Ἰηλυσσός*, which *Mercator* renders *Talyssus*, the MS renders *Ιλιός*,
Abulfeda

Abulfeda in some Copies situates the Island *Rhodes*, (for he mentions no Cities there) in the Latitude of 37 degrees, and 40 minutes: and the Geography of *Said Ibn Aly Algiorgany*, commended by *Gilbertus Gaulmyn*, in 37 degrees, if it be not by a transposition in the MS. of the numerical Letters in *Arabic* 37 for 36, which by reason of their similitude, are often confounded in *Arabick* MSS. By my observations under the Walls of the City *Rhodes*, with a fair brass Astrolabe of *Gemma Frisius*, containing 14 inches in the diameter, I found the Latitude to be 37° and 50'. A larger Instrument I durst not adventure to carry on shore in a place of so much jealousy. And this Latitude in the Chart I have assigned to the City *Rhodes*, (from the Island so denominated, upon which on the North East side it stands situated,) better agreeing with the *Arabians*, then with *Ptolemy*, whom I know not how to excuse.

FRANCISCI WILLUGHBEII *Armig.*
de Historia Piscium libri quatuor, fusu & Sump-
tibus Societatis Regiæ Lond. editi. Totum
opus recognovit, coaptavit, supplevit, Librum
etiam primum & secundum integros adjecit JO-
 HANNES RAIUS *e Societate Regia,*
 Oxonii è Theatro Sheldoniano, 1686.

I need say no more concerning the publishing of this work, or those worthy Persons who have most contributed thereunto, then what is already contained in the Title, the Dedicatory Inscription, and the Preface; however I cannot omit that we owe much more, than is there intimated, to the indefatigable Industry of M^r *John Ray*, a Person of polite and incomparable Learning, and of a most exquisite Judgement, especially in the *History of Nature*.

The work is divided into 4 Books, the *first* treats of Fishes in Generall: the *second* of the *Cetaceous* or *Whale* kind: The *Third* of *Cartilagineous* Fishes, that have gristles instead of Bones: the *fourth* and last of those they call *Spinose* Fishes, that have small sharp bones in their Flesh; after which is annexed a large Appendix.

In the first book are considered both the internall and externall parts of Fishes, as well those common to them, with other *Animals*, as those proper and peculiar to this kind; and the differences of the former, from those of like kind and denomination in Land *Animals* observed. The parts thus compared and consider'd, are the Eys, Mouth, Teeth, Tongue, Gills, Fins, Scales, Bristles, Beards, Lines: The Brains, the Stones found in their Heads, the swimming bladder, Gullet, Ventricle, Appendices,

pendices or Intestinula, Heart, Kidneys, Bladder, Anus, &c.

Next to the parts of Fishes and their uses, many things are sayd concerning their hearing, their respiration, their Motions, Generation, Food, Growth, Age, and their division, I will here only touch upon some particulars.

It is noted concerning the Eys of fishes, that they are flatter or more depressed then those of Quadrupeds, but the Chrystalline humour rounder, indeed either exactly Sphærical, or very near it. They want Ey-lids, and it is shewed that they are not necessary to them.

Concerning the hearing of fishes, it is remarked, that in no Fishes besides the Cetaceous kind, have hitherto been found any Auditory passages or Ear-holes, and whether they hear or no, is a question not yet fully decided, notwithstanding all the Experiments alledged to prove the Affirmative. For to that of calling the fishes together to meat in the Arch-Bishop of *Saltzburg's* Garden by the tolling of a Bell, it may be answered, that for ought is said in the Relation, the Bell might be hung in the Fishes sight; and so they observing the motion, not hearing the sound, might hasten to the place where it was made, in hope of a bait; just as did the Fishes observed by *S^t Augustine* in a certain Pool in the Territory of *Boll*, which having been used to be fed by Persons looking into the water, as soon as any man appeared walking on the brink, would presently swim up to them in Sholes, and attend them as they walked to and fro, in expectation of food. Howbeit this experiment might easily be improved to a demonstration, by placing the Bell behind a Curtain or Screen quite out of the Fishes sight; for if then upon ringing they make to the place whence the sound came, it will, necessarily follow that they can hear.

Concerning the Gills of Fishes it is shewn, that they
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are but as it were inverted Lungs, and are of the same use to Fishes as Lungs to Quadrupeds: that the whole mass of blood in every Circulation passes through the Gills, as in Quadrupeds it do's through the Lungs; only it returns not again to the heart, and therefore in Fishes as well the Vessels that carry it to the Gills, as those that bring it back, are Arteries. It is also proved, that fishes have a kind of respiration, as well as Land *Animals*, and that the use of the *Air* is as necessary to those as these; so that if it be intercluded, or made any ways unfit for life, they cannot live, as is clearly evidenced by great variety of undoubted experiments.

The fins serve not so much for progressive motion, as for holding the body erect, and for moving it to and fro, upwards and downwards in the water: the progression is performed principally by the motion of the Tail, by the sudden extension whereof being inflected, the Fish shoots it self forward with great force and Velocity.

Vid. Phil. Transf. N. 115.

The swimming-bladders found in most fishes, serve to bring the body to an *Æquilibrium* with the Element wherein it swims, that so it may with more facility be impelled or moved any way. That this is one use of it, is demonstrated from experience, for upon breaking the said Bladder, the fish is no longer able to support it self in the water, but presently sinks down, and constantly lies groveling at the bottom, from this *Air*-bladder there is a Channell or passage in most fishes, leading to the mouth of the Stomack, but in some few to the bottom of it, and there terminated: which probably serves for the emission and reception of *Air* at pleasure, to ballance the body according as either its gravity, or that of the Medium is altered. It is also probable that the fish hath a power of contracting and dilating this Vessel, either by some muscular force inherent in its Coats, or by the help of some externall

adjacent or appendent muscles, to facilitate the ascent or descent of the body in the water, or to detain it in any depth of water.

The received opinion that fishes have neither Reins nor Bladder for Urine, is from experience contradicted, it being found by dissection, that few fishes want a bladder, none Reins.

The situation of the Appendices or blind-guts, is observed to be different in fishes from what it is in other *Animals*; for in these they are situated at the end of the Guts, at least of the small Guts; in those at the beginning next the Stomack. These Appendices in the severall species of fish, vary extreemly as to their number, figure and magnitude, as is declared in particular by severall Instances.

Next to the parts of fishes and their uses, many things are said concerning the generation of fishes, which is shewn to be threefold, according to the three cheif kinds of Fishes. For 1. the *Cetaceous* kind (which are rightly called by the Latines *Belluæ Marinae*, *Sea-Beasts*) generate exactly after the manner of *Viviparous Quadrupeds*.

2. The *Cartilagineous* kind somewhat resemble Birds in their manner of Generation, for they breed large Eggs with distinction of Yolk and White, only they do not lay them, but cherish and hatch them in their Wombs, and so bring forth live young ones, as Vipers, and perhaps some other sorts of Serpents do.

3. The *Spinose* kind, (under which name are comprehended all other fishes beside the forementioned,) conceive an innumerable number of small Eggs called *Spawn*, which probably answer to the *Cicatriculæ* in Birds Eggs, and that (as is conceived) without any Coition or Copulation with the Male; on which Spawn, so soon as it is cast by the Female, the Male or *Milt* presently comes and scatters his *Milt* or Seed.

In the last place is delivered a generall division of fishes, not according to the place, (which method is for very good reasons rejected by M^r Ray,) but according to the Characteristick Notes of Nature.

As 1. Into the *Cetaceous* kind, which in most of their internall parts, the conformation of their brain, their manner of respiration and generation, agree exactly with *Viviparous Quadrupeds*.

2. The *Cartilagineous* kind, by which name are not to be understood all sorts of fishes that have gristles instead of Bones, but those which *Aristotle* calls σκῆλη, which are, (as he phrases it,) inwardly *Oviparous*, breeding great Eggs like to those of Birds, or rather Serpents, but outwardly *Viviparous*, laying and hatching those Eggs in their own bellys, and so bringing forth live young.

3. The *Spinose* kind, under which name are comprehended all fishes that are *Oviparous*, or cast their Spawn, indeed all besides those belonging to the two foregoing genera.

Those of the *Cetaceous* kind being but few, are not subdivided in this work.

The *Cartilagineous* kind are divided into those that are long and round bodyed, called *Sharks* and *Dogs*; and those that are flat and broad, which are again subdivided into Subordinate Genera.

The *Spinose* Fishes (which are the most numerous) are divided into. 1. the flat kind, which Swim lying on one side; as the *Sole*, *Plaife*, &c.

2. The *Anguilli-formes* or *Eel-like* fishes, that are long, slimy, and lubricous, having either no Scales or very small ones; many of which want the belly fins, or lower pair of fins; such are the *Conger*, *common Eel*, *Sea-Serpent*, *Eelpout*, &c.

3. Fishes of a shorter, more contracted, and thicker body, that want the second or lower pair of fins. Of

this kind are the *Globe-fishes*, either prickly or smooth; the *Triangular* and *Quadrangular* fishes, the *File-fishes*, *Hippocampi*, &c.

The rest of this kind, which have two pairs of fins, are divided according to the number and quality of their back-fins into

4. Such as have three fins on their backs, which are only those of the *Cod-kind*.

5. Such as have two fins on their back, and. 1. such as have them both with soft and flexile Ray's or Nerves.

2. Such as have the foremost with stiff and spinose Ray's, the hindmost with soft and flexile.

6. Such as have but one single fin on the back, and. 1. such as have all the Rays of the sayd fin soft, flexile and nerveose. 2. Such as have the foremost ray's thereof stiff and spinose, the hindmost soft and flexile.

In the first Book is also exhibited a Catalogue of *English* fishes, as many as have come to the knowledge of the *Authours*; as well such as are found in Salt, as in Fresh Waters.

Note, that the two latter chief kinds of Fishes, *viz.* the *Cartilagineous* and *Spinose*, agree in their manner of respiration by Gills, and therefore in this Chapter the primary division of fishes, is into such as respire by the help of Lungs, and such as by the assistance of Gills, and these latter subdivided into *Cartilagineous* and *Spinose*. This may suffice for the first Book; the other three shall be run over in as few words as possible, we having laid down a generall Scheme of the whole.

The second book, which treats of *Cetaceous* fishes, gives first generall notes of this kind, 2^{dly}. particular Descriptions of the severall species, of which that of the *Porpoise* or *Phocaena* is our own; for these fishes are not frequently to be seen or procured.

In all the other Tribes of *European* fishes, there are very few, but what were seen by Mr *Willoughby* and
Mr

Mr *Ray*, and their Descriptions taken from the fishes themselves, not transcribed out of books. As for the *Indian* Fishes, they are partly borrowed from the best *Authors*, who have travelled the *Indies*, partly from dried fishes found in *Museums*.

The 3^d book contains the *Cartilagineous* kind. These have Gills in common with the *Spinose* Tribe, but instead of single apertures have five oblong holes on each side. These all want Scales and the swimming bladder, have gristles instead of bones, as their name imports, have their mouths in the prone or under side of their bodys; the Males have two *Penis*-like *appendices* annexed to the fins encompassing the Vent, and generate as is before declared. Many of these fishes are very voracious, and of speedy concoction, as the *Sharks*; yet no Acid humour is to be perceived by tast in their Stomacks, of which there is a very memorable example.

The 4th Book, which comprehends all the *Spinose* and *Oviparous* fishes, is divided into many *Sections* or subalter-nate *genera*, the titles whereof are already enumerated.

In the 3^d of which Sections, which is concerning round or short bodied fishes, there is a great number never before published, exactly described and figured, the discovery and observation whereof is wholly owing to the Industry of the learned and ingenious Dr *Martin Lister*, who with great pains and diligence searched them out in the publick *Museums* and Cabinets about *London*. Possibly there might be found as great diversity's in some other kinds of fishes, had they been with the like diligence sought out by *Mariners* and *Fishermen*, who may think those of an uncouth shape, of a Cruaceous Skin, and disposition to dry, and keep without alteration of figure, to be the best merchandize for them; so that they may perhaps neglect and slight many other kinds.

In this Section is also an Account given of the man-

ner of taking the *Sword-Fish*, which is much like to the *Whale Fishing*. It is remarkable of this fish, that tho' for bigness it might be reckoned of the *Cetaceous* kind, yet is the flesh thereof of so delicate a tast, that the *Messinese*, and other Inhabitants of *Sicily* and *Italy*, whereabouts it is taken, are as fond of it as our people of *Mackrell*, or fresh *Herrings* at their first coming, so that it is sold for one *Tari* per pound, which is little less than six pence *English*.

In the 4th Section of this book, a particular and exact account is given of the severall sorts of fishes of the *Trout* or *Salmon* kind, and of the manner and whole process of their generation and mixtures, and of their fishing; as also of the *Tunny* fishing, which is so great advantage to the *French*, *Italians*, and other Nations bordering on the *Mediterranean* Sea. In the same Section is described the manner of the *Pilchard* and *Herring* fishing, as also the ways of curing them when taken, and of smoking and redding *Herrings*.

For other particulars of the book, and for the whole Appendix, the Reader is referred to the work it self.

But that which gives this work the greatest advantage above any other *History of Fishes* hitherto published, and recommends it to the purchase and perusal of all curious and ingenious persons, is the clear and accurate method, the many new Observations, the multitude and elegance of the *Sculpts*; in all which respects jointly taken, it far transcends any book of this nature already extant. The number of Copper Plates being little short of 200, in which are figured 388 fishes, besides 37 in the Appendix. The new figures designed from the life are 128, of which 30 at least of fishes never before exhibited or described, for which we ought to thank Dr *Lister*.

GODEFRIDI BIDLOO, M. D. *Anatomia Humani Corporis*. Amstel. Fol. 1685.

THIS Anatomy is perfectly *Demonstrative* or *Iconographical*, consisting of a hundred and five Tables of large and most Elegant Cutts, with Explications of them: the Draughts were taken by the curious *Gerard de Lairefs*, and are said to be all *Originalls*: the method observed is 1. of the *Head*, 2^{ly} of the *Breast*, 3^{ly} of the *Abdomen*, 4^{ly} of the *Womb*, as it is in Women great with Child, and of the *Fætus*, &c. 5^{ly} of the *Muscles* of the *Limbs*, 6^{ly} the *Osteology*. Tis a beautifull work, which without ingaging in controversies concerning the Uses of Parts, represents to the Ey the whole Anatomy of Man.

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N. 168. p. 888. l. 32. *for* finde. *r.* find. l. 33. *dele* it. p. 889. l. 31. *r.* the. p. 891. l. 15. *r.* to Hort-hair cut something. p. 892. l. 13 *dele* Parenthesis. p. 898. l. 8. *r.* Succus Citri. l. 23. *r.* endeavors. p. 901. l. 5. *r.* scent. p. 906. l. 28. *r.* (as he styles it.) p. 913. l. 34. *r.* thus with the Acidum. Put.

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